DOCUMENTED BRIEFING

RAND

Sourcing Decisions for Air Force Support Services

Current and Historical Patterns

Edward G. Keating, Frank Camm, Christopher Hanks

Project AIR FORCE

DB-193-AF

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Prepared for the United States Air Force

Project AIR FORCE

PREFACE

To enhance military readiness or quality of life and/or to reduce cost, the Air Force is currently seeking opportunities to expand outsourcing of support activities. RAND's Project AIR FORCE is supporting this effort with a project that addresses several aspects of expanded privatization and outsourcing. This documented briefing reports the results to date of one line of inquiry in that project: Where should the Air Force look within its support activities for additional outsourcing candidates?

This briefing addresses a group of activities that the Air Force refers to as "commercial activities." By definition, these activities are available in the private sector. That does not mean that the private sector can necessarily provide them more cost-effectively than the Air Force can. But the Air Force buys many of these services from private sources already. Private sources should be available if the Air Force decides to buy additional services of this kind.

This briefing focuses on two issues. First, of all the current activities that the Air Force has identified as commercial, how many has it already outsourced? How do outsourcing patterns depend on the major command and on activity type? When the effects of major commands and activity types are accounted for, how much cross-installation variation remains? Second, the Office of Management and Budget requires the Air Force to use an "A-76 program" to compare organic and contract costs for most commercial activities other than depot maintenance. (Depot maintenance is excluded from A-76 cost comparison by Title 10, Section 2469 of the U.S. Code.) How has this program worked in different parts of the Air Force and for different kinds of activities? What can we infer from that about how the A-76 program would affect additional outsourcing in the future?

This briefing should be of interest to managers and analysts concerned with support matters in the Air Force, especially those involved in outsourcing and privatization, and to support services managers and contracting officials in the other military departments and in the Office of the Secretary of Defense.

This work was carried out as part of the project on Improving Readiness Through Increased Access to Private Sources of Support in the Resource Management and System Acquisition Program of Project AIR FORCE.

The project was sponsored by the Deputy Chief of Staff for Logistics, Headquarters, USAF.

PROJECT AIR FORCE

Project AIR FORCE, a division of RAND, is the Air Force federally funded research and development center (FFRDC) for studies and analyses. It provides the Air Force with independent analyses of policy alternatives affecting the development, employment, combat readiness, and support of current and future aerospace forces. Research is being performed in three programs: Strategy and Doctrine, Force Modernization and Employment, and Resource Management and System Acquisition.

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SUMMARY

To enhance military readiness or quality of life and/or to reduce cost, the Air Force is currently seeking opportunities to expand outsourcing of support activities. The Air Force already outsources a significant portion of its support activities, but recent trends and events suggest that additional outsourcing, pursued in the right quarters, could improve the performance and/or lower the cost of Air Force support activities. Outsourcing is expanding in the commercial sector as new sources become available and new methods of contracting prove themselves effective. And the end of the Cold War has brought changes in contingency planning that could allow greater reliance on external sources of support services.

As a first step toward understanding what opportunities exist for expanded outsourcing, this documented briefing examines the current pattern of outsourcing "commercial activities" and recent experience in the Air Force with outsourcing. By definition, these activities are available in the private sector. That does not mean that the private sector can necessarily provide them more cost-effectively than the Air Force can. But the Air Force already buys many of these services from private sources. And private sources should be available if the Air Force decides to buy additional services of this kind. In particular, this briefing focuses on two questions:

- What factors affect the current pattern of outsourcing of commercial activities in the Air Force?
- What factors affect the probability of completing and the time required to complete the key steps associated with outsourcing a commercial activity?

CURRENT PATTERNS OF OUTSOURCING

As noted above, the Air Force already outsources a significant portion of the activities that it has identified as commercial. Some Air Force installations contract extensively, but a large number use only minimal contractor participation. Among the commands, the Air Force Materiel Command and Space Command installations exhibit the greatest tendency to outsource for support services, controlling for activity type. Across activity types, controlling for installations' commands, the Air Force most

often outsources research and development support and non-repair–oriented logistics activities (called "other nonmanufacturing" in our Air Force database). However, even within commands and activity types, considerable variability can still be present across installations. It is possible that the experiences at those installations that have contracted extensively could be informative for those that have not. This proposition deserves further attention.

OUTSOURCING INITIATIVE COMPLETION PATTERNS

Outsourcing in the Air Force has occurred in a variety of ways. For example, new missions, e.g., repair of a new weapon system, can be turned over to contractors directly. Also, some functions were turned over to contractors many years ago. For instance, a large total base-support contract at Vance Air Force Base has been in place since the early 1960s. See Shishko, Paulson, and Perry (1977). Similarly, Los Angeles Air Force Base has extensively used contracting since a number of maintenance and other service contracts were put in place before the installation officially became an Air Force station in April 1964.

In this research, however, we focus on attempted and completed outsourcing initiatives in the Air Force dating back to the late 1970s. We use the term "initiative" in this briefing to refer to both A-76 cost comparisons and direct conversions. During this period, the Air Force canceled about three outsourcing initiatives for every seven completed. Given the nontrivial costs of undertaking an outsourcing initiative, we analyzed the pattern of initiative completion versus cancellation in the Air Force since the late 1970s.

Across functions, social services initiatives have been most often completed. On the other extreme, 18 depot repair and 12 manufacturing initiatives were started in the Air Force. The 18 depot repair initiatives were all canceled. Meanwhile, two manufacturing initiatives are in progress, but the other ten were canceled.

Initiatives started in the late 1980s were particularly vulnerable to cancellation. One reason is a mandate first imposed in the FY91 Appropriations Act to cancel single-function initiatives that have not reached bid opening within two years of their announcement.

Our analysis also suggests that A-76 public-private cost comparisons were significantly more likely to be canceled than direct conversions, where the only choice is among contractors.

TIME REQUIRED FOR OUTSOURCING

Federal regulations and statutes require that the Air Force use a complex set of rules to outsource support activities. Recent discussion of outsourcing support activities in the Department of Defense as a whole has raised questions about how long it takes to comply with these rules and laws (assuming eventual completion). From Fiscal Year (FY) 1979 through July 1, 1996, half of all completed outsourcing initiatives in the Air Force took more than a year-and-a-half from the time a public announcement formally opened the initiative to the bid opening. Of course, actual performance by a contractor or chosen in-house organization followed the bid opening. Recent debate has given special attention to Office of Management and Budget (OMB) Circular A-76. Because of this document and related rules and laws, the Air Force must usually compare the bids of organic and contract sources before outsourcing commercial activities other than depot maintenance (which is excluded by law) and to outsource only if the contractor's bid is cheaper than the in-house shop's bid by at least a margin of 10 percent of the in-house shop's personnel costs. Holding major relevant factors constant, completed initiatives using A-76 procedures typically took about 200 days longer to bid opening than direct conversions, which did not use A-76 procedures. Processing times appear to have improved recently, but variability remains high. One possible reason for the apparent recent speed increase is the aforementioned FY91 Appropriations Act mandate to cancel single-function initiatives that have not reached bid opening within two years of their announcement. Hence, this apparent speed increase may be, at least in part, illusory due to data censoring from increased initiative cancellations.

What accounts for the observed variability in times to initiative completion? One factor is the initiative's function under study. Other things equal, initiatives for education and training have taken less time to bid opening than those for other functions. Base maintenance initiatives have tended to take longer to bid opening than other functions' initiatives.

Even when we control for all the factors for which we have data, however, variability remains high. The factors underlying variability in the time required to complete these initiatives require additional analysis. Understanding the sources of this variation better should provide a way to get the outsourcing process under control and to shorten the process by applying lessons learned in places where times have been short to those where they remain long.

ACKNOWLEDGMENTS

The authors appreciate the assistance of Annie Andrews of the Air Force Directorate of Programs and Evaluation (AF/PEM) in the Pentagon and Manuel Salazar, Linda Dunwiddie, and Terri Stringfellow of the Air Force Management Engineering Agency (AFMEA) at Randolph Air Force Base for providing and explaining the Commercial Activity Inventory Reporting System (CAIRS) and Commercial Activity Management Information System (CAMIS) data. Jan Hanley loaded these data onto RAND's computer system and assisted in the analysis. Her amiable and competent assistance has been most valuable. Al Robbert provided a thoughtful and careful review of this work. Laura Baldwin, Brent Bradley, David Chu, Susan Gates, Glenn Gotz, John Halliday, Jim Hosek, Susan Hosek, Michael Kennedy, Gary Massey, Craig Moore, Nancy Moore, Ellen Pint, Bob Roll, Mark Wang, and Susan Way-Smith provided helpful comments on this work. Rick Bancroft and Roberta Shanman provided library assistance. Phyllis Gilmore edited this document. Maj Paul Bricker, Lt Col Armand Grassi, and Major Jamie Manker were Air Force fellows at RAND who assisted on this research. John Adams, Marc Elliott, Lionel Galway, and Becky Kilburn provided statistical advice. Jan Harris, Laura Morrison, Regina Sandberg, Bari Whitbeck, and Carol Zaremba provided secretarial support. Sandy Petitjean designed the graphics on pages 9–14. Sung-ho Ahn, Angela Al-Mansour, Rodger Madison, Bob Schoeni, and Neal Sofge provided computer assistance. William Greene of Econometric Software, Inc., provided rapid and helpful LIMDEP assistance. We also appreciate the insights of personnel we have visited at Los Angeles Air Force Base, Randolph Air Force Base, Scott Air Force Base, and Vance Air Force Base.

This research was presented to numerous audiences including

- A RAND logistics lunch, May 17, 1996.
- AFMEA, May 29, 1996.
- Maj Gen John W. Handy, June 3, 1996.
- Gen Thomas S. Moorman, Jr., Lt Gen Lloyd W. Newton, Lt Gen George T. Babbitt, and Brig Gen Joseph H. Wehrle, Jr., June 17, 1996.
- Walter J. Hosey, Director of Economics and Business Management (SAF/FMCE), Office of the Air Force Comptroller (SAF/FM), September 5, 1996.

- The USAF Outsourcing and Privatization Conference, October 7, 1996.
- The Center for Naval Analyses (CNA)/RAND Infrastructure Conference, October 17, 1996.

The comments of seminar participants were appreciated. Of course, remaining errors are the authors' responsibility.

ABBREVIATIONS

ACC	Air Combat Command
ADP	Automated data processing
AETC	Air Education and Training Command
AF	Air Force
AFB	Air Force Base
AFMC	Air Force Materiel Command
AFMEA	Air Force Management Engineering Agency
AFP	Air Force publication
AF/PE	Air Force Office of Programs and Evaluation
AFSOC	Air Force Special Operations Command
AFSPC	Air Force Space Command
AMC	Air Mobility Command
CA	Commercial activity
CAIRS	Commercial Activities Inventory Reporting System
CAMIS	Commercial Activities Management Information System
CMD	Consolidated Manpower Database
CME	Contractor manpower equivalents
Depot	Depot repair
DoDFACs	Department of Defense functional activity codes
Education	Education and training
FY	Fiscal year
Health	Health services
IIA	Independence of irrelevant alternatives
IMaint	Intermediate maintenance
Install	Installation services
MEO	Most Efficient Organization
OMB	Office of Management and Budget
OtherNon	Other nonmanufacturing
PACAF	Pacific Air Force
PWS	Performance work statement
R&D	Research and development
RPM	Real property maintenance
SAC	Strategic Air Command
USAFE	U.S. Air Forces Europe

[redacted]

Sourcing Decisions for Air Force Support Services: Current and Historical Patterns

[redacted] RAND

The Air Force is initiating an effort to expand the proportion of its support services that it buys from external sources. The Air Force expects this to improve the cost-effectiveness of its support service. This briefing reports the results of one portion of a broader RAND study of how the Air Force can expand its reliance on external sources in the best way, from the Air Force's perspective. This briefing focuses on documenting what the Air Force currently buys from external sources. It also examines how well one process important to outsourcing, the Office of Management and Budget's (OMB) Circular A-76 cost-comparison process, has performed over time (see United States Office of Management and Budget, 1996) .

This analysis draws heavily on data in the Air Force's Commercial Activities Inventory Reporting System (CAIRS) and Commercial Activities Management Information System (CAMIS) from the Air Force Management Engineering Agency (AFMEA). We thank AFMEA and the office it reports to on the Air Staff, the Office of Programs and Evaluation (AF/PE), for their cooperation in facilitating access to these data and helping us understand the results of our empirical analyses of these data.

Outline

- **Current Outsourcing Patterns**
- **Patterns of A-76 Initiative Completion**
- **Outcomes of Completed A-76 Initiatives**
- **Patterns in the Time to Complete A-76 Initiatives**
- **Conclusions**

We start by discussing the current pattern of outsourcing in the Air Force. We look at differences across support services and installations and use statistical models to explain the patterns we observe.

We then look at three important elements of the A-76 program over the period from FY78 to July 1996: what proportion of initiatives the Air Force attempted were completed, the outcomes of completed initiatives, and how long it has taken the Air Force to complete these initiatives. We use the term "initiative" in this briefing to refer to both A-76 cost comparisons and direct conversions. Again, we look at variation across support services and installations and use statistical models to explain the patterns we observe.

The briefing closes with brief conclusions.

At the end, we have included our analyses of the two principal data sets, CAIRS (Appendix A) and CAMIS (Appendix B).

Commercial Activity Definition

- **"A Commercial Activity is an activity that provides a product or service obtainable (or obtained) from a commercial source. A Commercial Activity is not a governmental function."**
- **Source: AF Pamphlet (AFP) 26-12, September 25, 1992, p. 7**

To understand the data we use and the outsourcing processes that the Air Force uses to choose sources for non–depot-level support services, it is important to distinguish between "commercial" and "noncommercial" activities. A function is deemed to be a commercial activity if the function is one performed by commercial enterprises in the private sector. The Air Force can outsource only commercial activities.

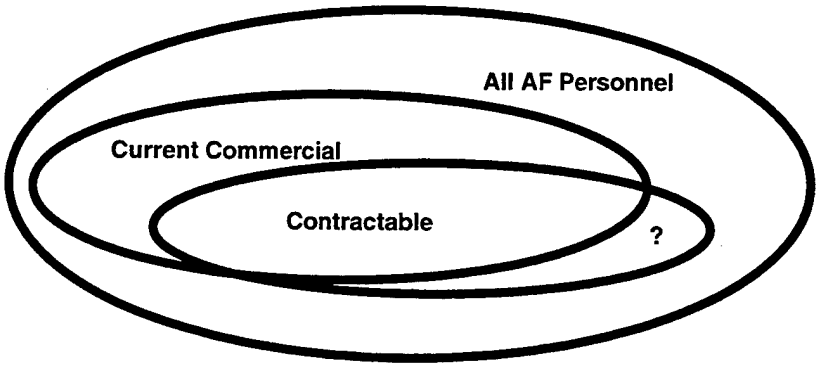
The Air Force uses the CAIRS data system to track the commercial activities that it might outsource. The empirical results reported in this section rely on CAIRS data.

Governmental Function Definition

- **"A governmental function is one that is so intimately related to the public interest as to mandate performance by Department of Defense employees. These functions include those activities requiring either the exercise of discretion in applying governmental authority or the use of value judgment in making decisions for the government."**
- **Source: AFP 26-12, September 25, 1992, p. 7**

The definition of a commercial activity explicitly notes that "governmental functions" are not commercial activities. This chart shows the formal Air Force definition of a governmental function.

The Current Categorization System May Be Imperfect



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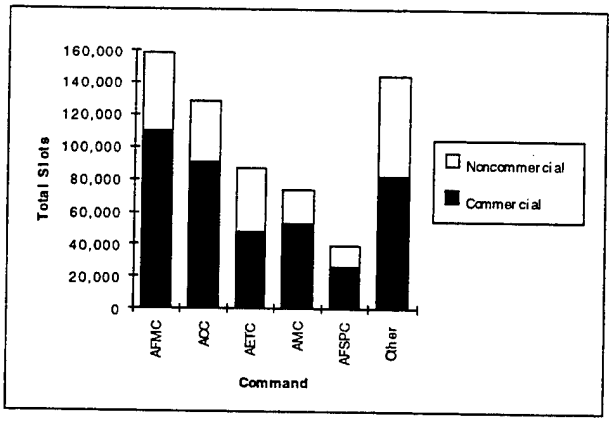
"Commercial" and "contractable" do not mean the same thing. Two considerations are important to understanding how they are related. First, not every commercial activity slot can be contracted out. Current "reason codes" in the 1995 CAIRS data eliminate 192,603 military commercial activity slots from consideration for "national defense," deployment, or rotation-base reasons, leaving only 27,239 military slots eligible for possible conversion to contract. On the government-employed civilian side, reason codes in the 1995 data eliminate 67,426 civilian slots from consideration, leaving only 21,850 slots that could be competed and possibly contracted out. Under current definitions, then, only 49,089 organic billets offer the potential for additional contracting.

The Air Force is currently reviewing these codes to reflect recent changes in contingency planning and other considerations. The number of billets that can potentially be outsourced could grow significantly. For instance, Gallay and Horne (1996) note the Army has made extensive use of contractors in recent deployments. Nevertheless, it is reasonable to suppose there will continue to be a number of "commercial" slots that cannot be contracted as a practical matter.

Second, the boundary between commercial and noncommercial can also change. Commercial activity experts at AFMEA and in AF/PE have noted it may be possible to reclassify some slots currently designated as noncommercial, thereby making those slots eligible for possible competition and contracting out. Such a change would expand the number of billets available for potential outsourcing.

AFMC and ACC are the Largest Commands



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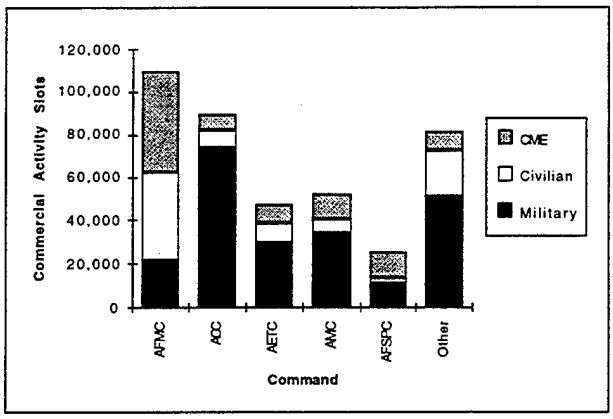
To provide overall perspective and scale, we begin at the top level by considering the totality of all military, civilians, and contractors associated with the Air Force as of September 30, 1995. In aggregate, 631,563 billets were associated with the Air Force. These billets include 378,333 military personnel, 158,516 government-employed civilians, and 94,714 contractor manpower equivalents (CME). This CME number is an estimate of the number of government employees who would be required to perform a function currently performed by contractor employees. Viewed in this way, Air Force Materiel Command (AFMC) at 158,348 and Air Combat Command (ACC) at 127,930 were the largest of these commands. The military and government-employed civilian totals are authorizations; actual populations may be somewhat lower.

AFMC Has More Commercial Activity Billets Than Any Other Command

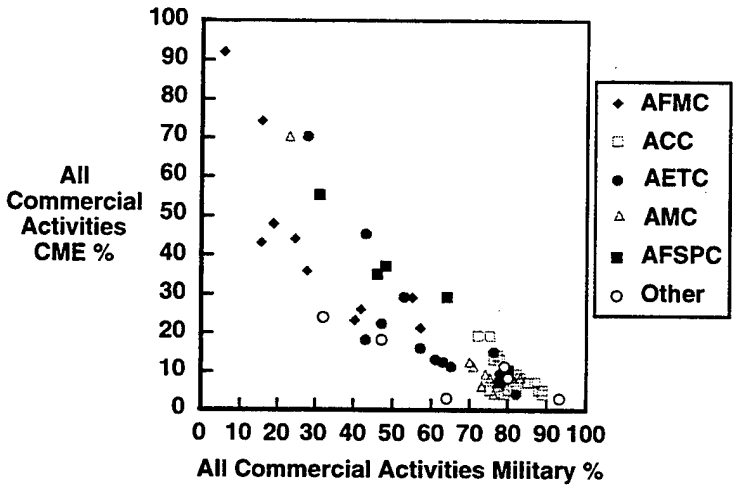


Of the total shown on the previous chart, 403,832 billets were considered commercial at the end of FY 1995. These included 219,842 military and 89,276 government-employed civilian commercial billets. As noted, the military and government-employed civilian billet totals represent authorizations; actual manpower may be somewhat lower. Meanwhile, the contractor component of the total (94,714) is the number of CME billets covered in the CAIRS database.

Not only is AFMC the Air Force's largest command; it also has the most commercial billets (109,223). The Air Education and Training Command (AETC) is a larger command than AMC, but the Air Mobility Command (AMC) has slightly more commercial billets (51,966 versus 47,089).

The different major commands use different proportions of military, government-employed civilians, and contractor labor in their commercial activities. More military are performing commercial activities than government-employed civilians in every command except AFMC. Air Force–wide, more than twice as many military personnel perform commercial activities than government-employed civilians (219,842 and 89,276, respectively).

U.S. Installations Vary Greatly in Proportional Usage of Military, Contractors



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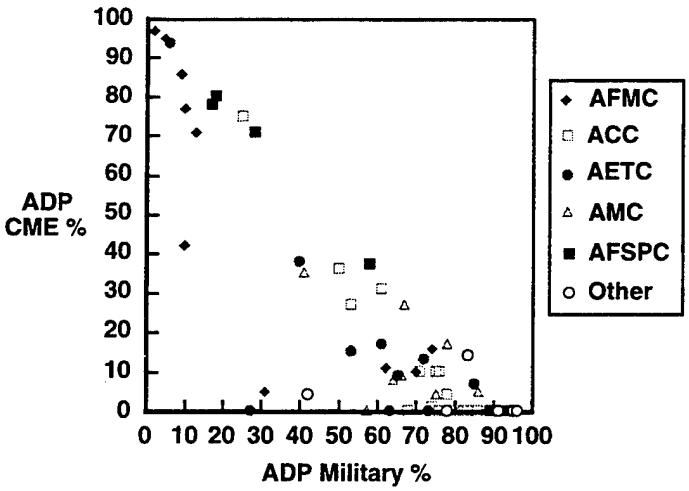
There are 63 major Air Force installations in the United States not currently slated for closure or major realignment.

This figure plots the military and contractor labor force fractions at these installations according to the CAIRS data.

Implicit in this display is the government-employed civilian percentage. At (0,0) in this plot, 100 percent of the billets would be filled by government-employed civilians. If one drew a line between (100,0) and (0,100), by contrast, no government-employed civilians would be employed by installations that fell on such a line. For example, in this figure, the Air Force Academy is the "o" lying at (32,24). This point shows that government-employed civilians hold 44 percent of the billets there.

We see that a handful of installations use considerable contracting. Los Angeles Air Force Base (AFB) is the installation in the upper left hand corner. Meanwhile, many installations cluster on the lower right, where their commercial activity billets are dominated by military members. We want to understand the variability displayed in this figure better.

Data Processing Approaches Vary; 23 Installations Use No Contractors



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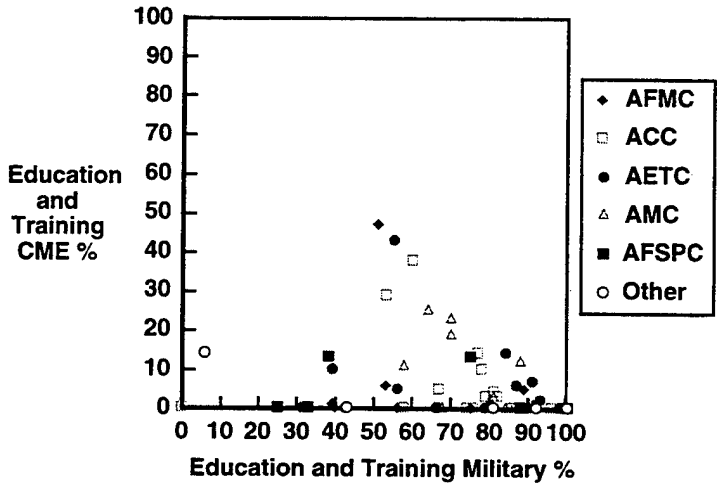
Differences across installations may stem from mission differences at the installations. Differences in mission will lead different installations to buy different mixes of support services. By looking at differences across installations that persist when we focus on one support-service function, we can control for *some* of the effects of differences in mission. This and the next few charts illustrate a variety of sourcing patterns for different support services.

This figure uses the same format as the previous chart, but focuses on one support-service function that commercial firms often outsource, automatic data processing (ADP). We still see substantial variability across installations. Nine installations use military for over 90 percent of their ADP billets; three use contractors for over 90 percent. A total of 23 installations, by contrast, use no contractors at all for ADP.

Table A.7 in Appendix A provides more detail. ADP and the other support-service functions discussed below are all defined to be consistent with the functional categories in the March 1996 *Revised Supplemental Handbook to OMB Circular A-76.*

Outsourcing Is Not Common in Education and Training



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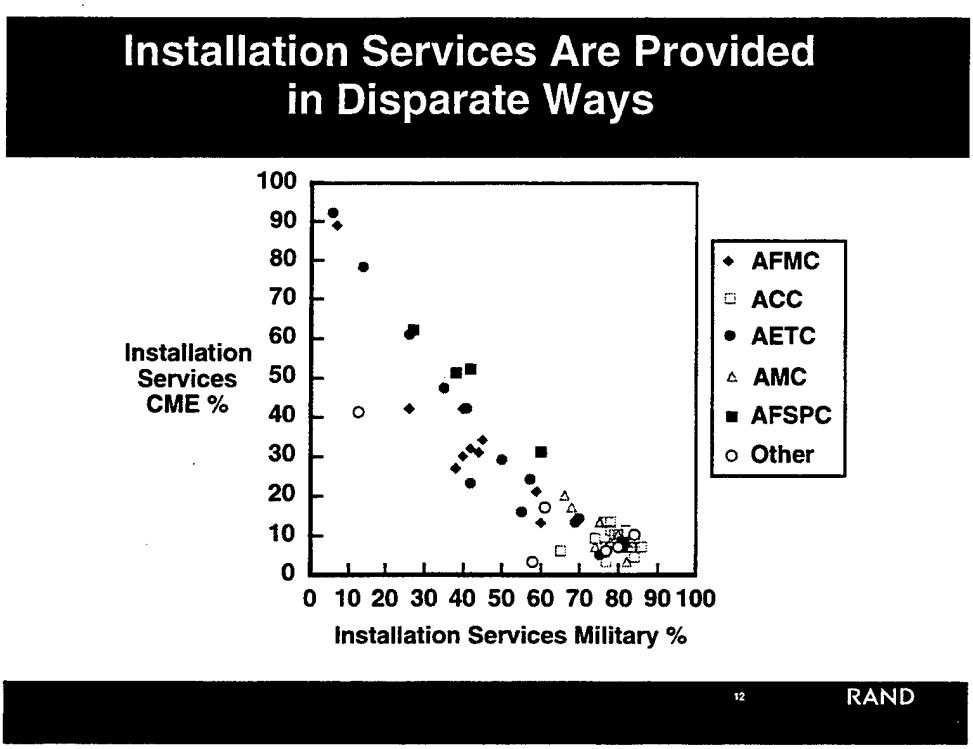
The pattern of variation is different for training and education. A total of 32 of the 63 installations use no contractors in this support-service function. (Note: We refer to the *general* function of education and training in this overhead. This function is not limited to AETC.) Even the highest outsourcing installation in this category, Kirtland AFB, uses contractors for less than 50 percent of its billets.

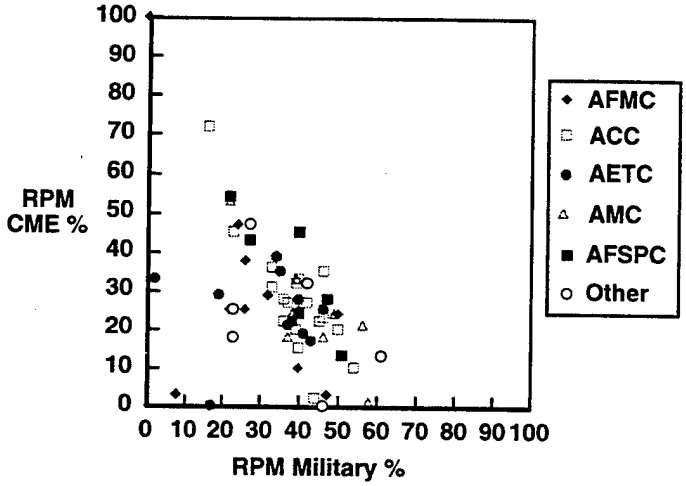
MacDill AFB uses government-employed civilians exclusively for education and training; its point is at (0,0) in this figure.

Table A.8 in Appendix A provides more detail on the data in this figure.



Installations use a variety of approaches for providing installation services, including base maintenance and umbrella contract billets. (Appendix A discusses the reasons for this combination.) Indeed, even among the six AFSPC installations, one finds wide variance, with Malmstrom AFB using 81.4 percent military in installation services and Patrick AFB using contractors for 62.3 percent of its installation support-service billets.

Military Is Not as Predominant in Real Property Maintenance



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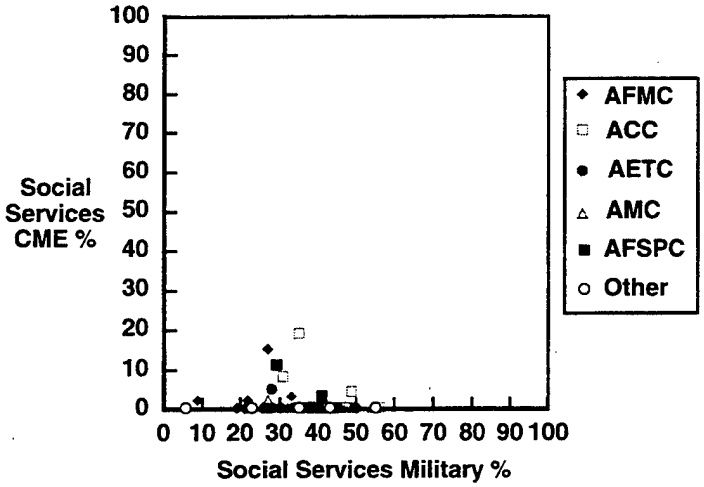
Military participation is somewhat less prominent in real property maintenance (RPM). Hurlburt Field, the most military-oriented installation, uses military for 61.2 percent of its RPM billets. Again, however, we see a wide range of approaches. Los Angeles AFB has contracted for 100 percent of its RPM; Hickam AFB and Lackland AFB use no contractors.

Social Services Has Very Little Outsourcing



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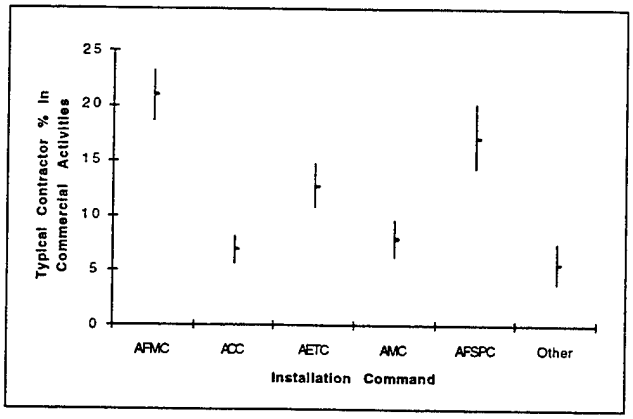
Fifty-one of the installations have no contractor participation in social services, which involve appropriated-fund Morale, Welfare, and Recreation activities and such functions as operation of the commissary and bachelors' quarters. Paradoxically, we show below that A-76 initiatives for social services functions have typically been completed quickly and without serious cancellation problems. Further, there are limited deployment issues with this function.

Other considerations may be influencing the use of government civilians in social services, e.g., an implicit policy to provide government employment to the family members of military personnel.

Outsourcing Is Most Prominent at AFMC, AFSPC Installations



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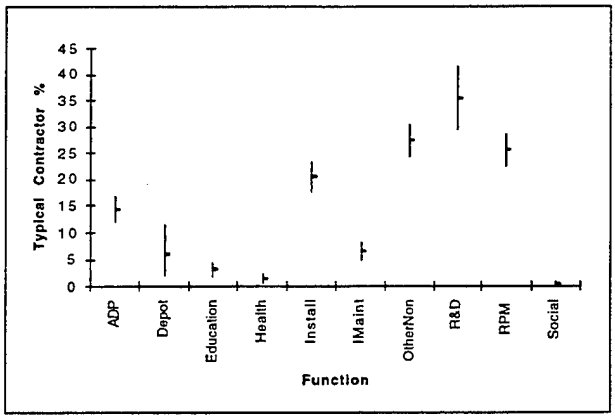
In an effort to formalize the intuition developed from the preceding scatter figures, we undertook an "arcsin analysis of covariance" to compare how the different types of labor are applied in commercial activities. This is a form of regression analysis that is more appropriate than simple linear regression analysis in cases like this, where bounds exist on the dependent variables; e.g., the fraction of billets filled by contractor labor cannot exceed 1 and cannot fall below 0. For a detailed discussion of the statistical model and results, see Appendix A.

In this figure, the middle tick represents our point estimate of each command's installations' outsourcing rate in a "typical" commercial activity, controlling for support-service function. The line on each side of the tick is plus and minus one Tukey-Kramer adjusted standard error around this point estimate (see Miller, 1985). With this type of portrayal, two commands' installations' outsourcing rates are statistically significantly different at the 95-percent confidence level if their lines do not overlap.

Controlling for support-service function, outsourcing is most likely at AFMC, AFSPC, and, to a lesser extent, AETC installations.

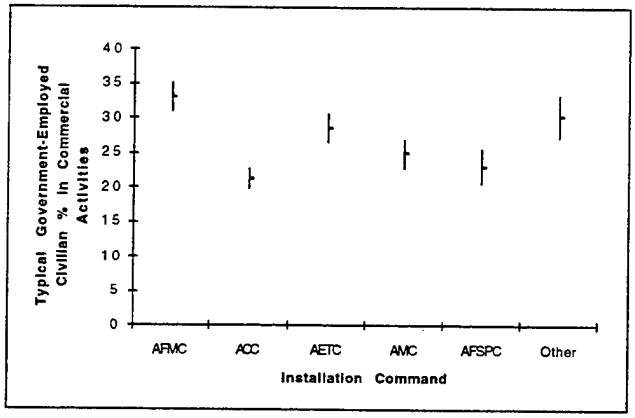
Outsourcing Common for R&D Support, Rare for Social Services



The statistical analysis discussed in the previous chart also yields information about differences in outsourcing patterns across support-service functions, holding the effects of individual major commands constant. By function, outsourcing is most prominent in research and development (R&D) support, other nonmanufacturing, and RPM, controlling for each installation's major command. Outsourcing is particularly rare in social services and health services, according to these data.

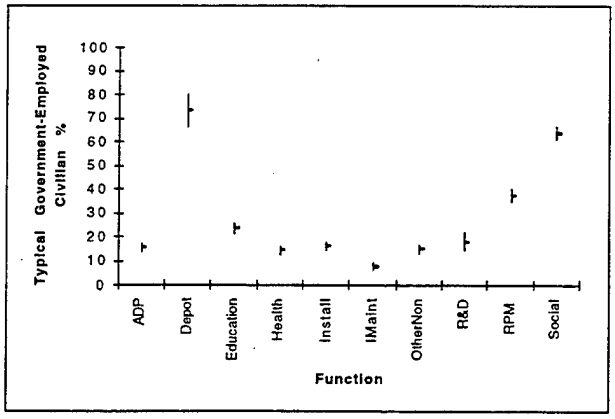
The functional categories are from the March 1996 *Revised Supplemental Handbook to OMB Circular A-76*. Pure R&D is exempted from A-76 cost comparison. In practice, however, this distinction is fuzzy (see Tighe, Trunkey, and Kleinman, 1996).

Government-Employed Civilians Are Least Prominent in ACC, AFSPC



The same statistical analysis can be applied to the proportion of commercial activities provided by government-employed civilians. This figure shows this proportion for each, controlling for support-service function. Government-employed civilians are comparatively least prominent at ACC and AFSPC installations. AFMC installations have the greatest comparative reliance on government-employed civilians.

Depot Repair, Social Services Are Dominated by Government-Employed Civilians



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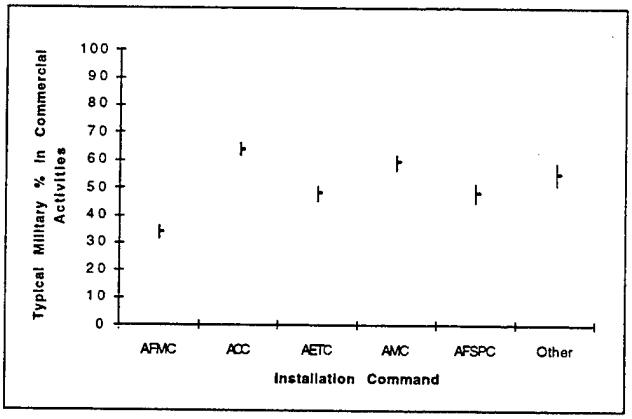
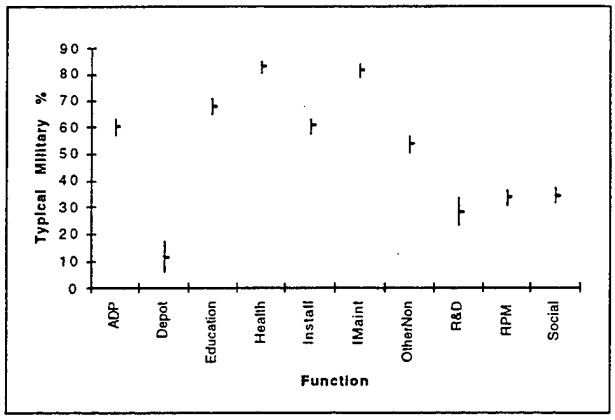
This chart shows the proportion of commercial activities provided by government-employed civilians in each support-service function, controlling for each installation's major command. Government-employed civilians are particularly prominent in depot repair and social services. Meanwhile, government-employed civilians are least common in intermediate maintenance.

AFMC Installations Make Least Use of Military in Commercial Activities



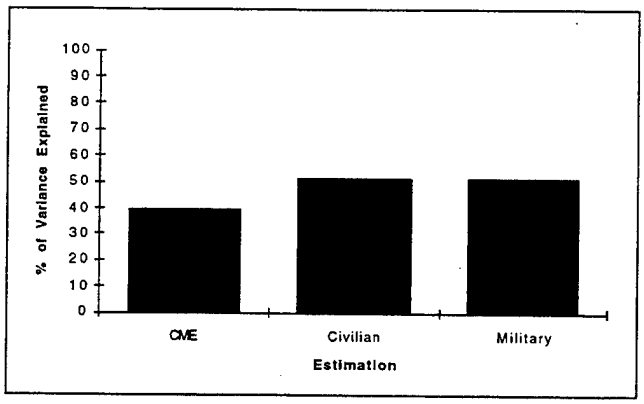
This figure reports our estimates for the proportion of commercial activities provided by military personnel in each command's installations, controlling for support-service function. Military labor is comparatively unimportant at AFMC installations.

Military Prominent in Health Services, Intermediate Maintenance



Controlling for installations' major command, military labor is proportionately most prominent in health services, intermediate maintenance, and education and training, but rare in depot repair.

Commands and Functions Only Explain a Portion of Variability



21 RAND

Our statistical analysis can only explain a portion of the variation across installations in the types of sources the Air Force uses to produce its support services. Looking across the equations for contract, government-employed civilian, and military sources, major command and support-service effects can only explain approximately half of the variability in installations' use of these types of personnel. Thus, even within command and support-service function, considerable variability still exists from one installation to the next.

Large Variability Still Occurs Within a Function Within a Command

Installation Services Billets

	Mil	Civ	CME
Falcon	176	25	92
Francis E. Warren	657	100	54
Malmstrom	600	76	61
Patrick	193	77	447
Peterson	261	37	328
Vandenberg	706	202	948

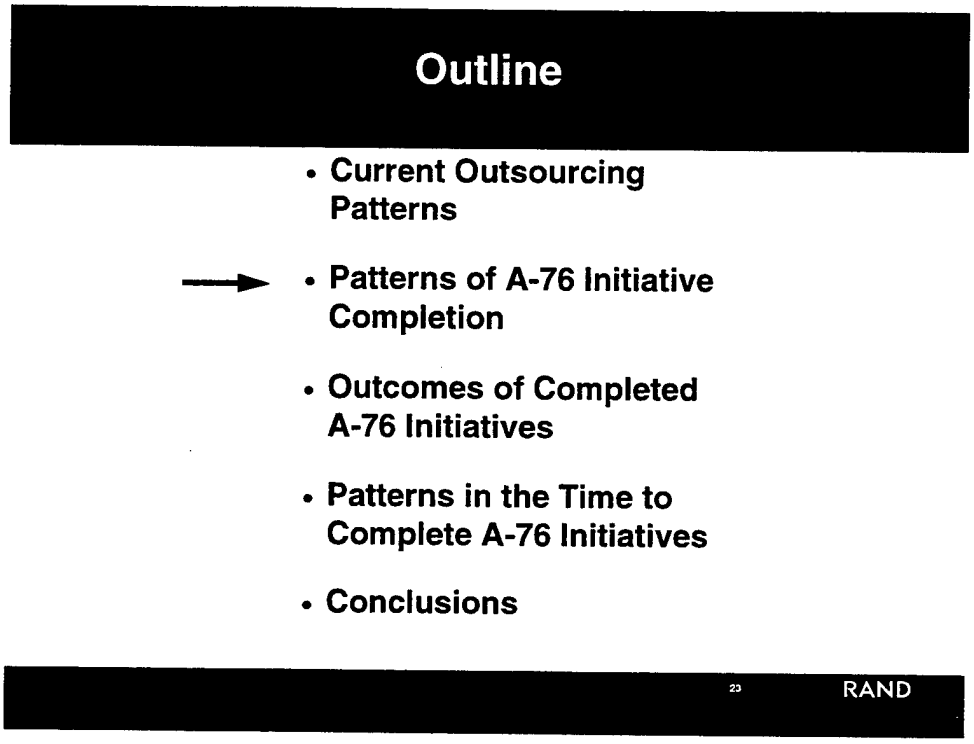
22 RAND

This chart is another way to illustrate the considerable variability that exists even within commands and support-service functions. As an example, this chart displays the pattern of military, government-employed civilians, and contractor billets in installation services across the six AFSPC installations.

At Malmstrom, 81.4 percent of the installation services billets are filled by military. Meanwhile, over half of Patrick's, Peterson's, and Vandenberg's installation services billets are filled by contractor personnel.

It would be instructive to investigate why these installations have chosen these different approaches. We know F. E. Warren and Malmstrom were Strategic Air Command (SAC) installations. Perhaps their military emphasis emanates from a different culture and outlook toward contracting in SAC than was the case in AFSPC. The question now is whether these installations' approaches remain optimal.

It is also possible that the disparate approaches shown in this chart are entirely appropriate for the respective installations' local conditions. Further investigation would be required to ascertain if this is the case.



Let us now turn to the principal process the Air Force uses to make sourcing decisions for non–depot-level support services, OMB's A-76 cost-comparison process. OMB and the Congress require that DoD use a specific set of accounts to compare the costs of public and private sources before moving most activities from a public to a private source (see U. S. Office of Management and Budget, 1996). Recent changes in A-76 will surely affect the Air Force's application of A-76 in the future. Nonetheless, information about its performance in the past provides an important context for any discussion of its use in the future.

Outsourcing in the Air Force has occurred in a variety of ways other than the A-76 process, however. For example, new missions, e.g., repair of a new weapon system, can be turned over to contractors directly. Also, some functions were turned over to contractors prior to the implementation of current procedures.

Nevertheless, in this research, we focus on A-76 cost comparisons and direct conversions. In a cost comparison, the Air Force uses a standard set of accounts to compare public and private sources. In a direct conversion, the

Air Force considers only external sources. The only competition allowed in a direct conversion is between external sources. Throughout this discussion, we use the term "initiative" to refer to both A-76 cost comparisons *and* direct conversions.

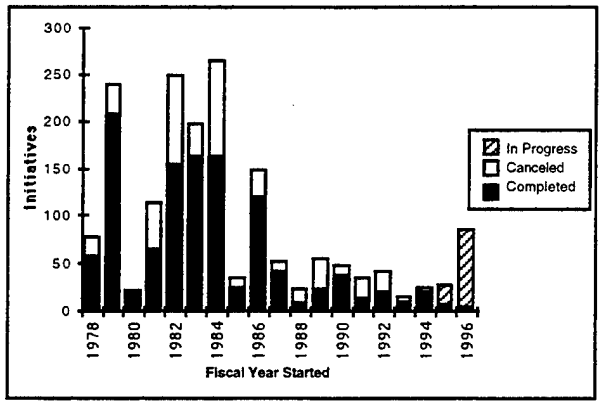
We Obtained the AF's CAMIS Data

- **Contains information on Initiatives: A-76 (public/ private) cost comparisons and direct conversions**
- **Data on 1,147 completed initiatives, 494 canceled initiatives, and 103 in-progress initiatives from FY78 to July 1, 1996**

To conduct this analysis, we obtained data from CAMIS. CAMIS contains information on outsourcing initiatives, completed, canceled, and in progress, in the Air Force, dating back to Fiscal Year (FY) 1978. Fairly in-depth records are kept of the milestones in initiatives, the outcomes of initiatives, the dollar value of the winning bid, the installations involved, and so forth. CAMIS contains information on both A-76 cost comparisons and direct conversions.

We should note, however, that considerable outsourcing in the Air Force predates this data set. For instance, a large total base support contract at Vance AFB has been in place since the early 1960s (see Shishko, Paulson, and Perry, 1977). Similarly, Los Angeles AFB has extensively used contracting since a number of maintenance and other service contracts were put in place prior to the installation officially becoming an Air Force station in April 1964.

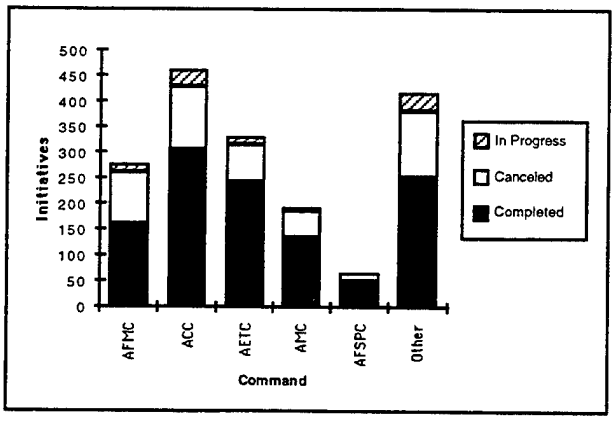
Initiative Starts Peaked in the Early 1980s



Here is a tally of completed, canceled, and in-progress initiatives Air Force–wide by fiscal year started as of July 1, 1996. Though the pattern is choppy, many more initiatives started in the early 1980s than in the late 1980s and early 1990s. FY96, even as of July 1, 1996, saw a considerable upturn in the number of initiatives started.

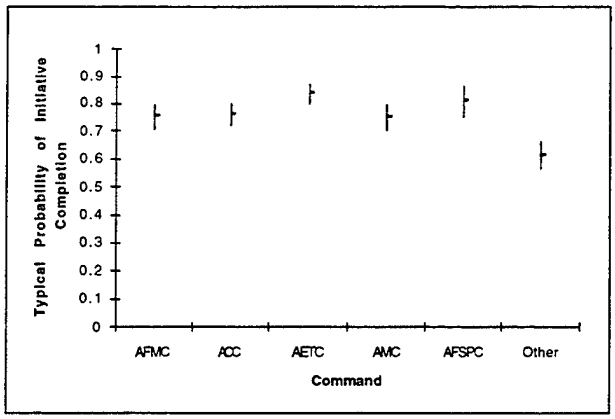
The Air Force has undertaken outsourcing initiatives not covered in these data. Depot-level outsourcings of maintenance services do not fall under the purview of A-76. New missions can be turned over to contractors without this sort of initiative. And outsourcings undertaken with or without A-76 before 1978 are not recorded in CAMIS.

ACC Has Started the Most Initiatives



This chart presents the five major United States–based commands in order of total population (military, government-employed civilians, and associated contractor employees) from left to right. Among the Air Force's commands, ACC has started and completed the most initiatives since the late 1970s. Although the AFMC is the Air Force's most populous command, it has started and completed fewer initiatives than ACC or AETC. Again, however, CAMIS does not cover the outsourcing of depot-level maintenance activities in AFMC.

The Large Commands Have Had Similar Initiative Completion Rates

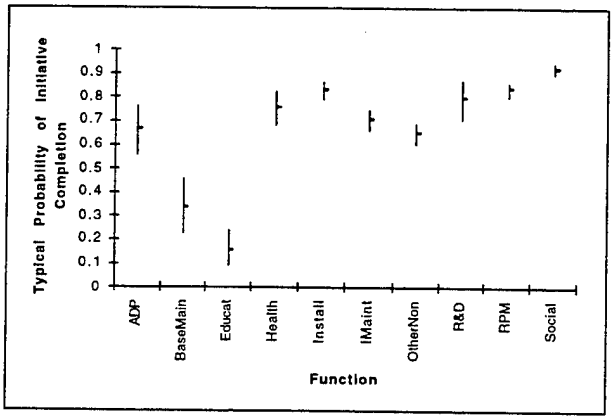


We undertook a probit estimation to analyze when and where Air Force initiatives have been completed versus canceled. For a detailed discussion of this probit model and the empirical results it generated, see Appendix B.

As before, the middle tick represents our point estimate of each command's typical probability of completing an initiative, controlling for other factors, e.g., the size of the initiative, the type of initiative, and the number of billets evaluated. These other variables are evaluated at their mean levels in this figure. The line on each side of the tick is an approximation of plus and minus one standard error around this point estimate.

This analysis suggests that the five largest major commands, highlighted here, have had completion rates that exceed those of the smaller commands and field operating activities included in the final column of the chart.

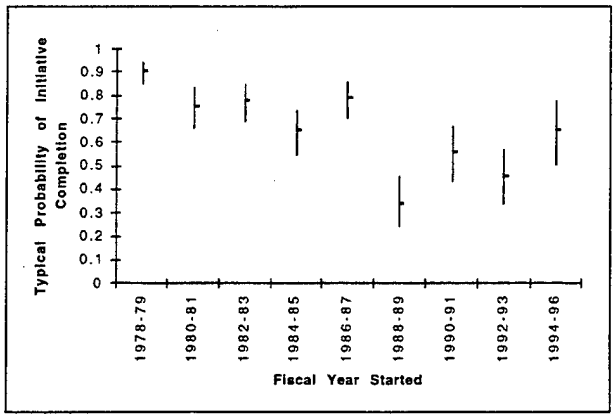
Social-Services Initiatives Have Been Most Likely to Be Completed



This figure shows the typical completion rate for initiatives by function, controlling for other factors. Social-services ("Social") initiatives have been relatively most likely to be completed. Meanwhile, education and training ("Educat") initiatives have been particularly prone to cancellation.

There were also 18 depot repair and 12 manufacturing initiatives started Air Force–wide, but all that are not currently in progress were canceled. The lack of variance in these outcomes meant probit coefficients for these functions were not estimable.

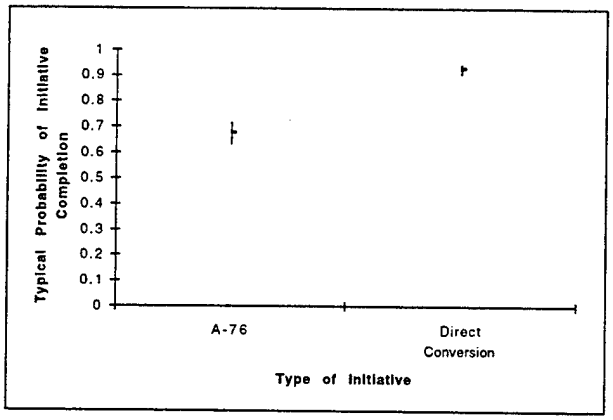
Early Initiatives Were More Likely to Be Completed



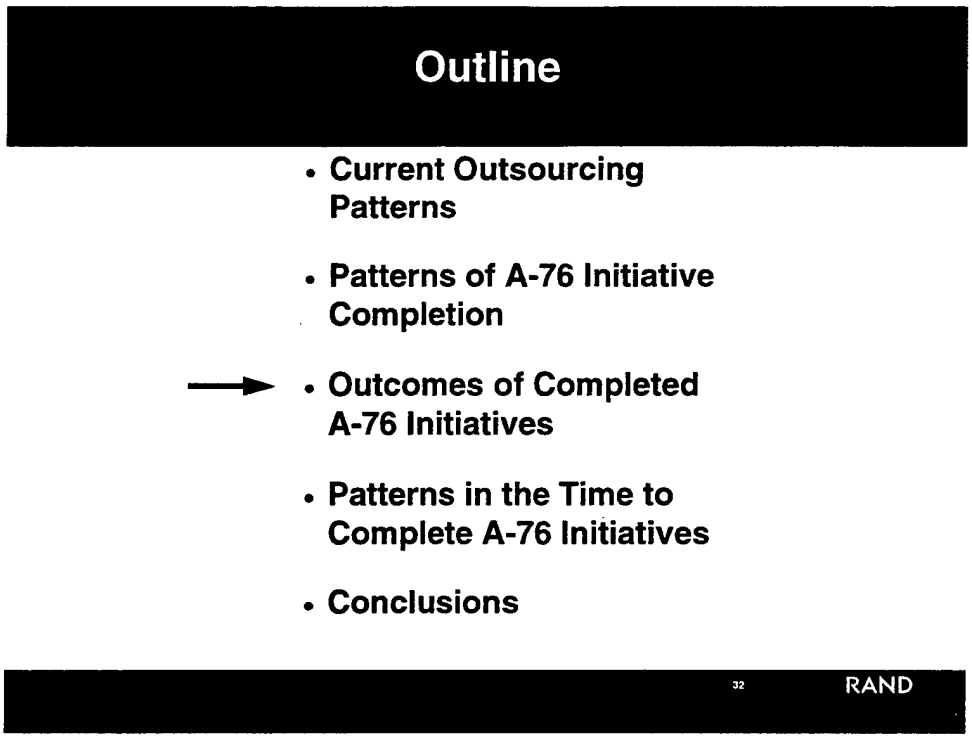
This figure shows typical probabilities of completion by fiscal year started, controlling for other factors. In-progress initiatives were omitted from this analysis. Some of the lines in this figure are fairly long, depicting considerable variance in completion rates within fiscal years started.

The FY91 Appropriations Act implemented a policy of canceling single-function initiatives after two years and multifunction initiatives after four years if they have not yet reached bid opening. Implementation of this policy may have caused the marked decline in the completion rate for initiatives started in FY 1988 and FY 1989.

Direct Conversions Were More Likely to Be Completed Than A-76 Cost Comparisons



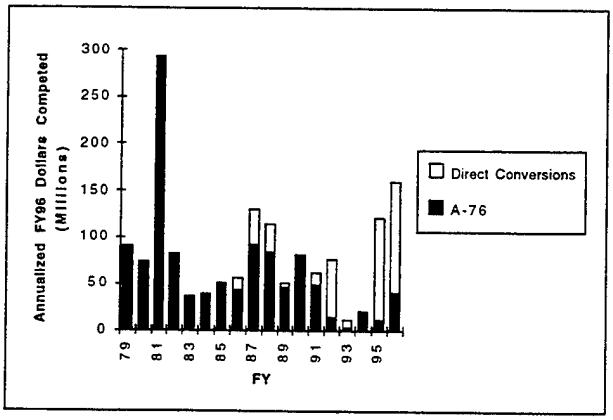
Controlling for other factors, our results suggest that direct conversions were statistically significantly more likely to be completed than A-76 cost comparisons.



Having discussed patterns in which initiatives are completed, we next provide some background data on the Air Force's completed initiatives.

Although the discussion above states that the Air Force completed 1,147 initiatives, our analysis in this section covers 1,092 initiatives. We omitted 55 initiatives that lacked starting dates, completion dates, or dollar values or were otherwise problematic for analysis purposes.

The Real Dollar Value of Completed Initiatives Declined Until Recently



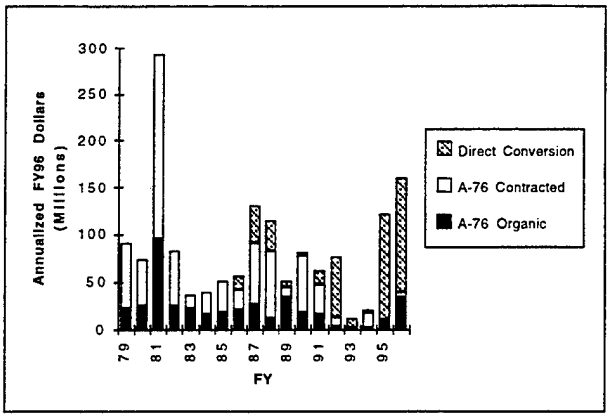
33 RAND

Looking at the annualized value of winning bids in completed initiatives expressed in FY96 dollars, we see there was a major diminution in initiatives in the early 1990s, particularly for A-76 cost comparisons. The dollar value of completed initiatives has increased in recent years, however. This figure covers completed initiatives since FY 1979, except the initiatives we omitted because of data difficulties.

Appendix B discusses the procedure we used to convert CAMIS's then-year dollar totals to FY 1996 dollars.

There are at least two potential explanations for diminution in real dollar value of initiatives completed in the late 1980s and early 1990s: (1) The FY89 National Defense Authorization Act specified that installation commanders had the sole authority to determine which functions to cost-compare or direct-convert. (This stipulation expired September 30, 1995.) Installation commanders on short tours may not have wished to incur the turmoil associated with initiatives. (2) The FY93 DoD Authorization Act imposed a DoD-wide moratorium on awarding contracts resulting from cost comparisons that was in effect until April 1, 1994.

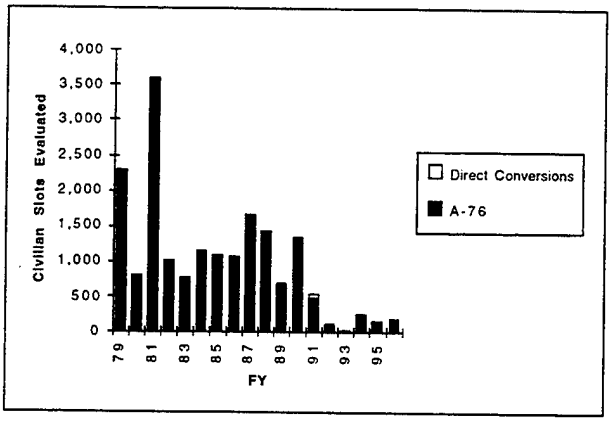
Most Initiative Dollars Have Gone to Contractors



34 RAND

In annualized FY96 dollar terms, contractors won the preponderance ($1.15 billion out of $1.55 billion) of initiatives. About $420 million annualized value of the contractor total came from direct conversions. Hence, of the dollars competed for through A-76 cost comparisons, contractors won roughly $736 million out of $1.13 billion or 65 percent.

Number of Civilian Billets Evaluated Has Precipitously Declined

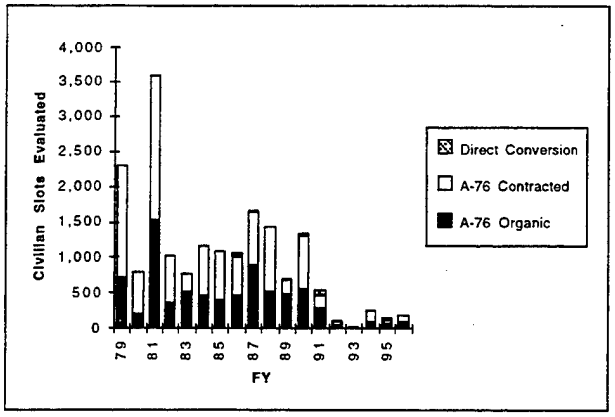


35 RAND

Page 33 notes a dramatic diminution in the dollar value and number of completed initiatives in the late 1980s and early 1990s. This diminution is particularly marked if one focuses on the number of government-employed civilian billets evaluated. Only 420 government-employed civilian billets were evaluated Air Force–wide in FY93, FY94, and FY95.

Not surprisingly, 17,927 of the 18,222 government-employed civilian billets evaluated came through A-76 cost comparisons. Direct conversion is only possible if ten or fewer government-employed civilians are affected.

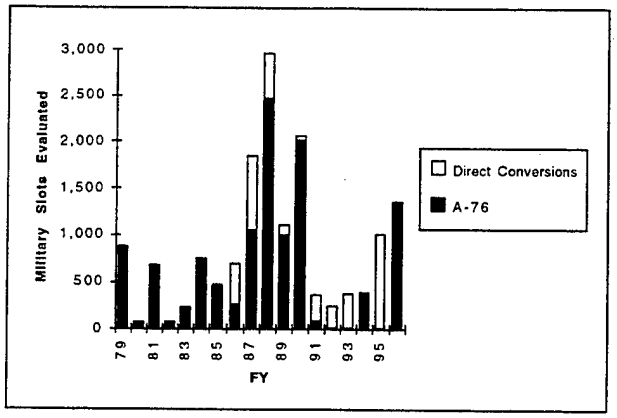
Contractors Have Won 58% of Civilian Billets Cost Compared



36 RAND

Contractors have won 10,428 of 17,927 (58 percent) civilian billets subject to cost comparisons. Contractors also won another 295 civilian billets through direct conversion.

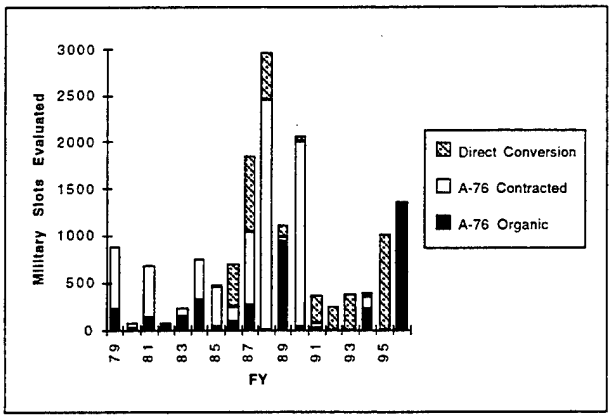
Initiatives Completed in the Late 1980s Focused on Military Billets



37 RAND

In contrast to the dollar value trend shown on p. 33, initiatives involving military billets peaked in the late 1980s. Referring to p. 35, initiatives in the early 1980s generally evaluated government-employed civilians, but initiatives completed in the late 1980s disproportionately evaluated military billets.

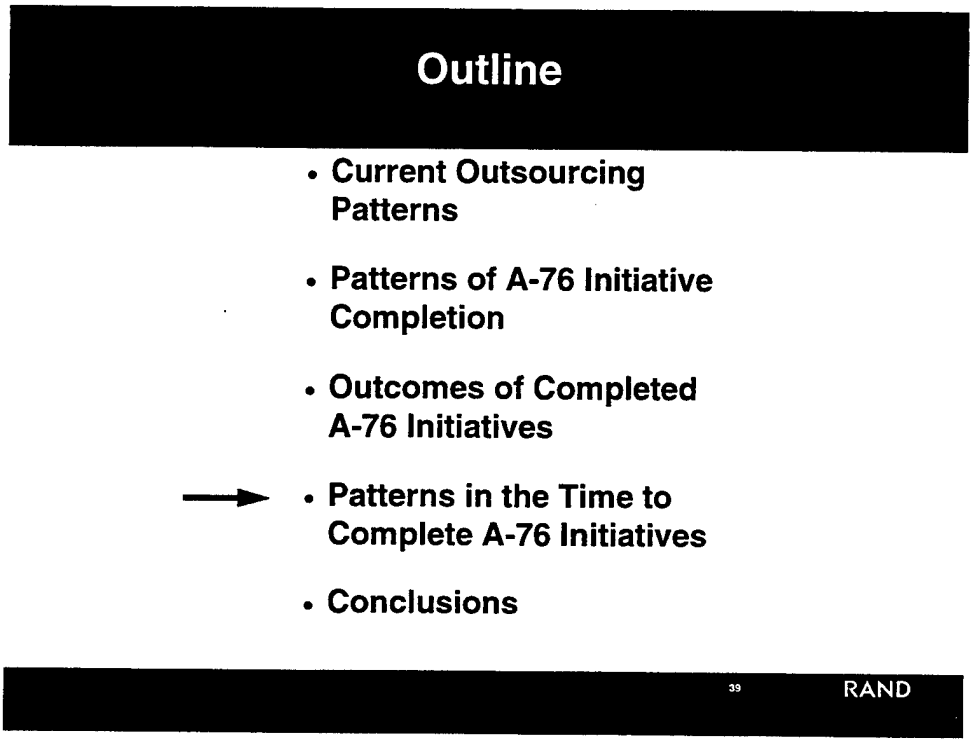
Contractors Won 68% of Military Billets Cost Compared



38 RAND

Contractors have won a larger percentage of military billets subject to cost comparison (7,897 of 11,670, or 68 percent) than of civilian billets (10,428 of 17,927, or 58 percent—see p. 36) subject to cost comparison. Further, contractors won another 3,918 military billets through direct conversion.

On the other hand, a government employee Most Efficient Organization (MEO) won a 1,319–military slot/50–civilian slot aircraft maintenance cost comparison at Altus AFB in FY96.



Next, we discuss the historical duration of completed initiatives. In this section, we further restrict ourselves to the 927 of the 1,092 completed initiatives that contain both an Announcement Date and a Bid Opening Date. The Air Force's definition of initiative duration is the time elapsed between the announcement date and the bid opening dates, and we wished to adhere to its definition in this section's analysis.

CAMIS Tracks a Variety of Dates

- **Announcement date**
- **Performance Work Statement (PWS) start date**
- **PWS completion date**
- **Contract solicitation issue date**
- **Completion of in-house MEO bid date**
- **Bid opening date**
- **Award date**
- **MEO implementation date**
- **Contract start date**

40 RAND

CAMIS contains a number of date fields for each initiative. When various steps in the initiative process are completed, the dates are recorded in CAMIS.

For the initiatives in CAMIS, the listed steps appear in the order shown more frequently than any other order. However, the data contain numerous cases in which the steps did not occur in the described sequence.

Unfortunately, many of the date fields are plagued by missing data, even if one appropriately controls for outcomes. For example, the MEO implementation date applies only when government employees win the initiative. However, even if one focuses solely on such cases, the MEO implementation date is often missing in CAMIS.

We Used the Air Force's Measure of Duration

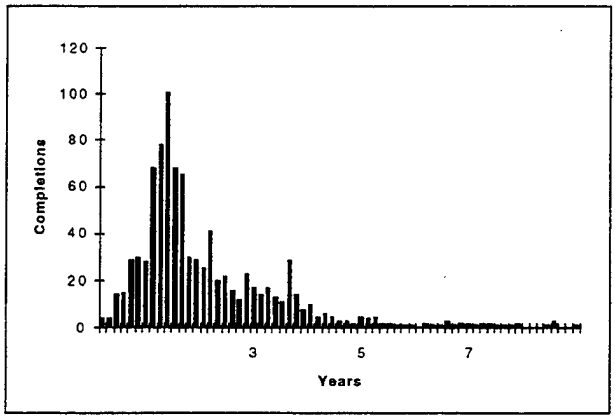
- **Begin: Announcement Date**
- **End: Bid Opening Date**

41 RAND

We used the definition of initiative duration used in the AF/PE, which is responsible for A-76 policy and oversight in the Air Force. Section 8020 of the FY91 Appropriations Act instructed the Air Force to track duration defined as the time from the announcement date to the bid opening date. Hence, Andrews (1996), for instance, defines duration in this manner.

As noted, this definition restricts our sample to 927 completed initiatives. In Appendix B, we present supplemental results using a 1,092-completed-initiative sample and a more inclusive definition of initiative duration. There are no important differences in the findings, although, of course, durations are greater when more inclusively defined.

The AF Initiative Process Has Been Long and Variable



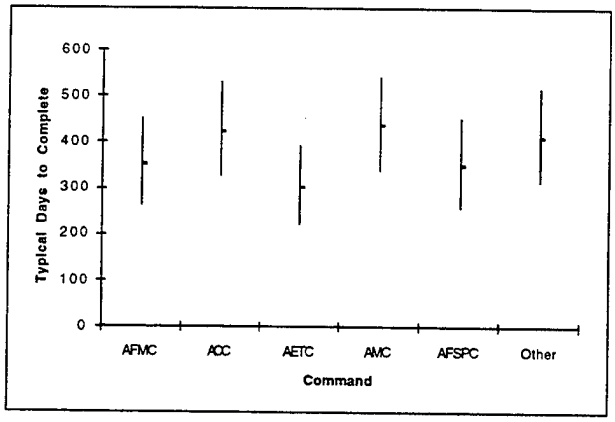
42 RAND

Using the congressionally mandated measure of duration, our analysis of completed initiative durations in CAMIS reveals a process that has been long and variable. This figure depicts a frequency distribution of the realized durations in the data.

Since FY79, the median completed initiative in CAMIS took 567 calendar days from the announcement to bid opening. The mean duration was 757 days. Further, the long tail on the right shows that past initiatives have exhibited considerable variability in how long they took to complete. Nearly 10 percent of the completed initiatives took four years or more to bid opening. One took over nine years to bid opening.

In the next charts, we assess whether the type of function, the major command, or other factors influenced durations. To do this, we apply an analysis of covariance, explained in detail in Appendix B, to the data displayed in this chart. (See also Pearce, 1982.)

High Standard Errors Blur Command Speed Differences

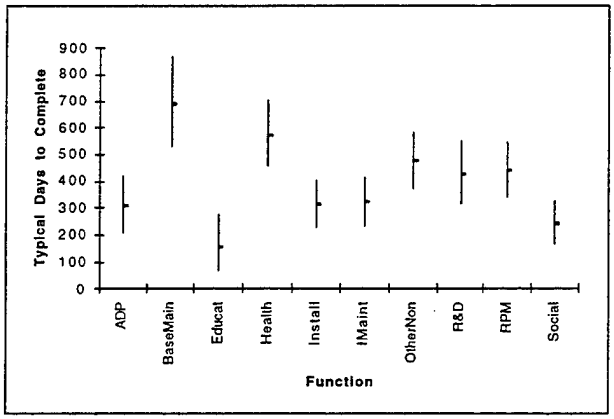


43 RAND

This figure compares major commands' initiative duration, holding constant other factors, e.g., size of initiative, function, time period, and type of initiative.

Large standard errors on the command estimates imply we cannot definitively disentangle different commands' speeds, controlling for other factors.

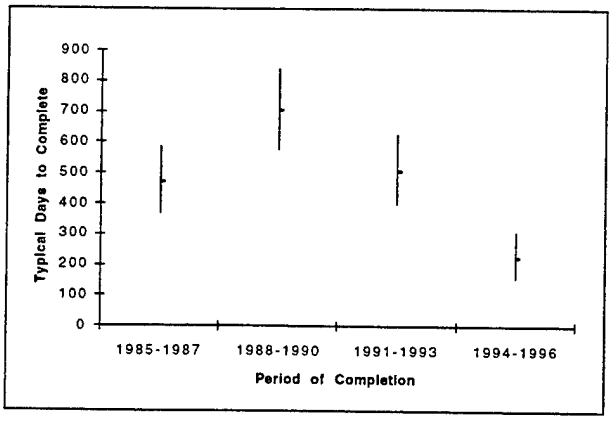
Education and Training Initiatives Have Been Most Rapid



44 RAND

This figure portrays typical completion times by service-support function, defined as they are in earlier sections. Holding command, time period, and type of initiative constant, significant differences in time to completion emerge among a number of these functions.

Initiatives May Be Getting More Rapid



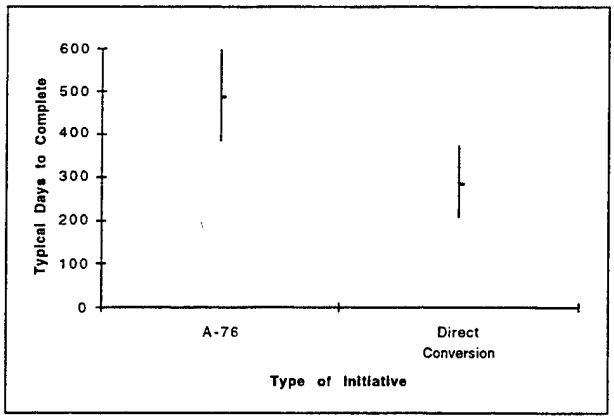
45 RAND

This figure portrays typical completion times by fiscal year of completion. We have controlled for support-service function, contract size, and major command.

The figure suggests that the durations of completed initiatives have gotten somewhat more rapid in recent years. One possible reason is the aforementioned policy first promulgated in the FY91 Appropriations Act of canceling single-function initiatives after two years and multifunction initiatives after four years if they have not yet reached bid opening. The policy may be speeding initiatives, or this apparent speed increase may be at least partially a data censoring caused by more initiatives being canceled (see p. 30).

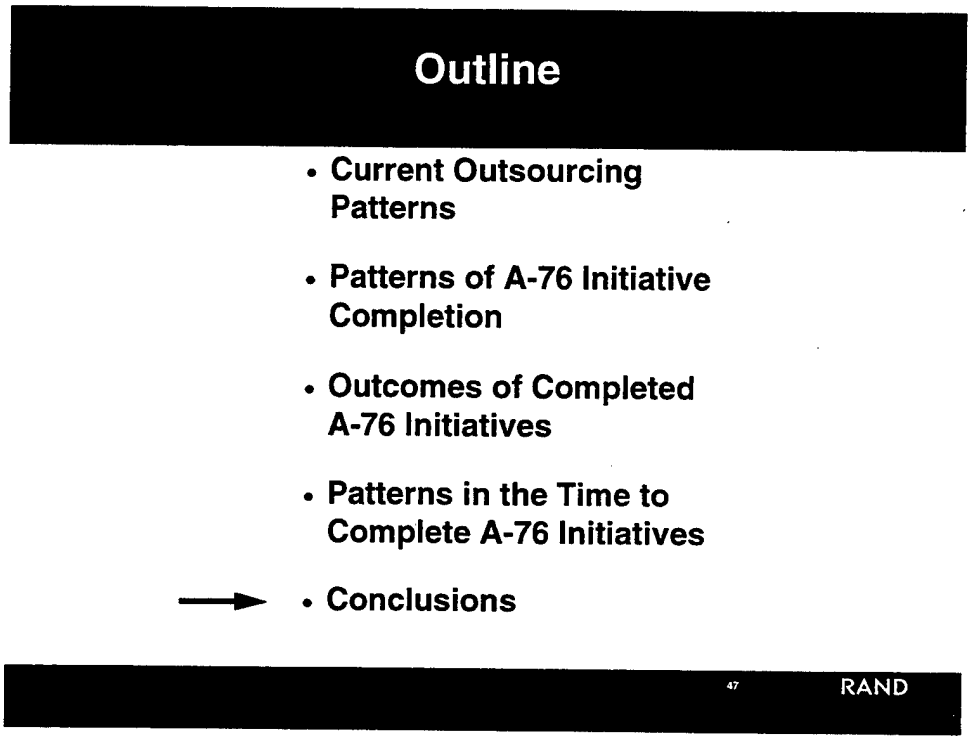
Another hypothesis is that the now-expired policy of giving installation commanders sole authority to commission A-76 cost comparisons discussed on page 33 resulted in those initiatives that did occur progressing more rapidly as commanders took a personal interest in them. Of course, if the commander-interest hypothesis is valid, initiatives commissioned by the Air Staff or the major commands (as is now allowable) will not go so rapidly.

Direct Conversions Have Been Faster Than A-76 Cost Comparisons



46 RAND

In this figure, we compare typical durations of direct conversions and A-76 cost comparisons. Our point estimate is that direct conversions were typically 200 days faster than A-76 cost comparisons, controlling for command, function, and time period. We can reject a null hypothesis that direct conversions took as long as A-76 cost comparisons at the 99-percent confidence level.



We close with some brief conclusions.

Conclusions (1 of 2)

- **Military sources of commercial activities deserve close scrutiny.**
- **Activities that rely heavily on contractors can teach the rest of the Air Force how to use external sources.**
- **It would be desirable to improve the completion rate and time to completion of A-76 initiatives.**

At the close of FY 1995, over half the commercial-activity billets in the Air Force were held by military personnel. It is possible current CAIRS reason codes overstate the number of commercial-activity billets that must be held by military personnel and hence cannot be contracted.

Considerable variability existed across and within commands and support-service functions in their usage of external sources. If the Air Force wants to increase its reliance on external sources, it may be appropriate to examine installations that rely relatively heavily on external sources for particular support-service functions to learn why these activities prefer external sources and how they manage them.

Between 1978 and 1995, the Air Force canceled about three initiatives for every seven it completed. Cancellation rates were higher after 1987 than before. Recently implemented automatic-cancellation policies appear to have exacerbated this problem (but may also have sped up those initiatives that were completed).

For completed initiatives, the Air Force A-76 process has been lengthy and variable in duration. There is some suggestion

the process has become more rapid in recent years, but this effect may be in part explained by a data-censoring effect as lengthy initiatives have been canceled.

Conclusions (2 of 2)

- **Direct conversions have been less likely to be canceled and faster to completion than A-76 cost comparisons.**
- **Contractors have won most, but not all, A-76 cost comparisons.**

Controlling for many important factors, direct conversions have been less vulnerable to cancellation and have been completed more quickly than A-76 cost comparisons.

Although contractors have won the majority of A-76 cost comparisons, organic shops have provided meaningful competition in many instances.

Appendix A

AN ANALYSIS OF THE AIR FORCE CAIRS DATA SET

According to the May 1996 *USAF Almanac*, the Air Force had 378,333 members and 158,516 civilian employees as of September 30, 1995. Table A.1 provides more detail on these Air Force–wide totals. These totals are consistent with those found in the Consolidated Manpower Database (CMD).

Of these 378,333 military members and 158,516 civilian employees, a portion have been deemed to perform "commercial activities." Commercial activities are those for which a determination has been made that a contractor could provide them.

CAIRS is a congressionally mandated database maintained by AFMEA at Randolph AFB for the Air Force. The CAIRS database tracks the number of authorized slots in the Air Force in those areas defined to be commercial activities. Authorizations may be somewhat greater than actual employment.

Table A.1

Population Totals by Major Command

Command	Military Members	Civilians
ACC	106,993	13,419
AETC	64,165	14,237
USAFE	27,608	5,451
AMC	53,114	9,293
AFMC	35,938	75,414
PACAF	34,210	8,340
AFSOC	9,243	516
AFSPC	23,224	4,970
Other	23,838	26,876
Total	378,333	158,516

SOURCE: *USAF Almanac*, May 1996. Data as of September 30, 1995.

The CAIRS database divides the slots into military personnel authorizations, government-employed civilian authorizations, and CMEs. The CME tallies represent an estimate of the number of government employees that would be required to perform a function currently performed by contractors. No salaries or costs are attached to these slots. Instead, authorized slots are simply tallied.

We obtained the FY95 CAIRS database from AFMEA. There are 403,832 slots in the FY95 CAIRS database. 54.4 percent are military personnel, 22.1 percent are government-employed civilians, and 23.5 percent are CMEs.

Table A.2 breaks the CAIRS data up by major command. This table shows that the Air Force Special Operations Command (AFSOC) and ACC have a particular emphasis on military labor in commercial activities. AFMC makes the greatest use of government-employed civilians. The AFSPC and the AFMC make the greatest use of contractors in commercial activities.

Table A.3, meanwhile, combines the data in Tables A.1 and A.2. This table shows that of the military in each command, portions ranging from 46 percent (AETC) to 69 percent (ACC) perform functions deemed commercial. Somewhat surprisingly, a slightly lower overall percentage of civilians than of military members perform commercial activities (56 and 58 percent, respectively). Only 36 percent of AFSOC's civilians are deemed to perform commercial activities, while PACAF is highest at 79 percent.

Table A.2

FY95 CAIRS Data by Major Command

Command	Military Slots	Civilian Slots	CME Slots	Mil %	Civ %	CME %
ACC	73,697	8,334	7,518	82.3	9.3	8.4
AETC	29,512	8,915	8,662	62.7	18.9	18.4
USAFE	17,449	2,616	3,602	73.7	11.1	15.2
AMC	33,880	6,656	11,430	65.2	12.8	22.0
AFMC	21,170	41,057	46,996	19.4	37.6	43.0
PACAF	23,339	6,560	2,262	72.6	20.4	7.0
AFSOC	4,872	183	110	94.3	3.5	2.1
AFSPC	10,813	2,463	11,726	43.2	9.9	46.9
Other	5,110	12,492	2,408	25.5	62.4	12.0
Total	219,842	89,276	94,714	54.4	22.1	23.5

Table A.3

FY95 Fraction of Slots Deemed Commercial

Command	CA[a] Military Slots	Total Military Slots	Mil CA %	CA Civilian Slots	Total Civilian Slots	Civ CA %
ACC	73,697	106,993	68.9	8,334	13,419	62.1
AETC	29,512	64,165	46.0	8,915	14,237	62.6
USAFE	17,449	27,608	63.2	2,616	5,451	48.0
AMC	33,880	53,114	63.8	6,656	9,293	71.6
AFMC	21,170	35,938	58.9	41,057	75,414	54.4
PACAF	23,339	34,210	68.2	6,560	8,340	78.7
AFSOC	4,872	9,243	52.7	183	516	35.5
AFSPC	10,813	23,224	46.6	2,463	4,970	49.6
Other	5,110	23,838	21.4	12,492	26,876	46.5
Total	219,842	378,333	58.1	89,276	158,516	56.3

[a]CA = Commercial activity.

As well as being divided by major command, CAIRS slots are divided by installation and by Department of Defense Functional Activity Codes (DoDFACs). DoDFACs are grouped into eleven categories, as shown in Table A.4.

Table A.4

FY95 CAIRS Data by Category

Category	Military Slots	Civilian Slots	CME Slots	Mil %	Civ %	CME %
ADP	3,958	1,542	2,417	50.0	19.5	30.5
Base maintenance	0	0	14,375	0.0	0.0	100
Depot repair	1,113	23,988	14,569	2.8	60.5	36.7
Education and training	8,173	2,575	965	69.8	22.0	8.2
Health services	33,683	6,278	873	82.5	15.4	2.1
Installation services	49,329	16,722	12,632	62.6	21.2	16.1
Intermediate maintenance	90,086	10,644	5,266	85.0	10.0	5.0
Other nonmanufacturing[a]	21,069	8,735	26,189	37.6	15.6	46.8
R&D	1,231	3,141	9,187	9.1	23.2	67.8
RPM	8,962	11,371	8,129	31.5	40.0	28.6
Social services	2,238	4,280	112	33.8	64.6	1.7
Total	219,842	89,276	94,714	54.4	22.1	23.5

[a]The "other nonmanufacturing" DoDFAC largely consists of logistics-related functions, e.g., storage and warehousing, transportation services, and property disposal.

Clearly, the extent of contracting and the utilization of military personnel vary considerably across these categories. In these data, intermediate maintenance and health services make heavy use of military labor. Depot repair and social services are dominated by government-employed civilians. Contractors are proportionally most prominent in R&D support, but arithmetically most prominent in installation services.

The base maintenance category is entirely run by contractors. In the CAIRS data, this category is exclusively used for base maintenance and "umbrella" contracts. Because it most closely represents a form of installation-services contracting, we merged it into that category and treat it as such henceforth. As discussed in Appendix B, government employees often win base-maintenance initiatives. The absence of government employees in this category in the CAIRS data leads us to suspect they are tabulated in another category in CAIRS, e.g., installation services.

One can also break the data up by installation. We focused on major installations in the United States that have not been slated for closure or major realignment. Looking at the 63 installations that meet these criteria, one finds enormous variance in how and where they use contractors. Use of military labor in performance of commercial activities runs from 5.7 percent at Los Angeles AFB to 92.8 percent at Hurlburt Field. The use of government-employed civilians ranges from 2.0 percent at Vance AFB to 43.8 percent at the Air Force Academy. Finally, use of contractors ranges from 2.9 percent at Hickam AFB to 91.8 percent at Los Angeles AFB. Most installations use considerable military labor and little contracting, but there are installations for which the opposite is true.

Table A.5 shows the ten installations with the overall most and least proportional use of military labor and contractors in commercial activities.

Eight of the top ten proportional users of military labor are ACC installations. Meanwhile, none of the top ten proportional contracting installations are in ACC; five of the ten are in AFMC.

An important factor in data of this sort is the dichotomy between command installations and command work. Table A.5 and subsequent tables show subcategory totals at major installations in the specified commands. These installation totals may include work performed for other commands, e.g., if there are tenant units from other commands.

Table A.5

FY95 CAIRS Overall Most and Least Proportional Use of Military and Contractor Labor in Commercial Activities

Rank	Installation	Command	Mil %	Installation	Command	CME %
1	Hurlburt Field	AFSOC	92.7	Los Angeles	AFMC	91.8
2	Shaw	ACC	89.0	Hanscom	AFMC	73.7
3	Pope	ACC	88.8	Vance	AETC	70.3
4	Cannon	ACC	88.5	Scott	AMC	69.7
5	Dyess	ACC	87.4	Peterson	AFSPC	54.6
6	Seymour Johnson	ACC	86.6	Tinker	AFMC	48.3
7	Moody	ACC	84.8	Columbus	AETC	45.2
8	Minot	ACC	82.9	Hill	AFMC	44.3
9	McConnell	AMC	82.7	Robins	AFMC	42.6
10	Mountain Home	ACC	82.3	Vandenberg	AFSPC	36.5
	Air Force average		54.4			23.5
54	Air Force Academy	NA[a]	31.9	Barksdale	ACC	5.0
55	Peterson	AFSPC	31.2	Cannon	ACC	5.0
56	Wright-Patterson	AFMC	28.4	Davis-Monthan	ACC	4.8
57	Vance	AETC	27.7	Pope	ACC	4.7
58	Hill	AFMC	25.0	Dover	AMC	4.5
59	Scott	AMC	22.8	Luke	AETC	4.4
60	Tinker	AFMC	19.5	Whiteman	ACC	4.3
61	Robins	AFMC	16.5	Shaw	ACC	4.0
62	Hanscom	AFMC	16.2	Hurlburt Field	AFSOC	2.9
63	Los Angeles	AFMC	5.7	Hickam	PACAF	2.8

NOTE: Data are only for major installations in the United States not slated for closure or major realignment.

[a]The *USAF Almanac*, May 1995, indicates that the Air Force Academy is a "direct reporting unit" that is not formally in a major command.

One can also look at the data by category and by installation. Again, marked variance in approaches emerges. Table A.6 summarizes these results.

We can also rank the installations by military and contractor use within these categories. Table A.7, for instance, ranks use of military and contractor labor in ADP.

Table A.7 shows there is wide variance in installations' use of military and contractors in ADP. AFMC installations are noteworthy for their comparative lack of utilization of military labor. It is perhaps surprising that 23 installations use no contractor support for this function.

Table A.6

FY95 CAIRS Data by Category and Installation

Category	Greatest Military Use	Mil %	Greatest Civilian Use	Civ %	Greatest CME Use	CME %
ADP	Eielson	96.0	Lackland	72.6	Brooks	96.8
Depot repair	Holloman	97.9	Davis-Monthan, Peterson, Wright-Patterson	100	Tinker	55.5
Education and training	Elmendorf, Falcon	100	MacDill	100	Kirtland	46.6
Health services	Hurlburt	100	McGuire	64.7	Malmstrom	9.8
Installation services	Dyess	85.5	Air Force Academy	45.8	Vance	92.5
Intermediate maintenance	Hanscom	100	Laughlin	93.6	Columbus	98.1
Other nonmanufacturing	Hurlburt	91.0	Air Force Academy	71.4	Los Angeles	96.2
R&D support	Charleston	90.0	Robins	92.3	Vandenberg	100
RPM	Hurlburt	61.2	Brooks	89.7	Los Angeles	100
Social services	Barksdale	56.2	Air Force Academy	93.6	Moody	19.4

NOTE: Data are only for major installations in the United States not slated for closure or major realignment.

Table A.8 shows wide variance in the use of military personnel in the education and training function. Indeed, even within commands, one finds both high and low users of military labor, e.g., ACC (Dyess high, MacDill low), AETC (Vance high, Maxwell low), AFMC (Tinker high, Robins low), and AFSPC (Falcon high, Frances E. Warren low). A handful of installations have meaningful contractor participation in education and training; more than half have none.

As was true in Table A.5, Table A.9 shows that military labor in installation services is most prominent at ACC installations. No ACC installation, meanwhile, is on the top ten installation-services contracting list. It is also interesting to note that AFSPC, while having only six installations, has top ten and bottom ten entrants in both the military and contractor fractions in installation services. As discussed above, installation services includes base maintenance and umbrella contracts.

Table A.7

FY95 CAIRS ADP, Most and Least Proportional Use of Military and Contractor Labor

Rank	Installation	Command	Mil %	Installation	Command	CME %
1	Eielson	PACAF	96.0	Brooks	AFMC	96.8
2	Barksdale	ACC	95.5	Los Angeles	AFMC	94.9
3	Bolling	NA	95.2	Columbus	AETC	94.1
4	McConnell	AMC	95.0	Wright-Patterson	AFMC	86.2
5	Whiteman	ACC	93.8	Peterson	AFSPC	80.4
6	Altus	AETC	91.7	Vandenberg	AFSPC	78.3
7	Elmendorf	PACAF	90.5	Hill	AFMC	76.9
8	Malmstrom	AFSPC	90.5	Offutt	ACC	74.8
9	Fairchild	AMC	90.3	Falcon	AFSPC	71.1
10	Francis E. Warren, Pope	AFSPC, ACC	89.5	Robins	AFMC	70.5
	Air Force average		50.0			30.5
53	Offutt	ACC	25.2	23 bases		0.0
54	Peterson	AFSPC	17.9			
55	Vandenberg	AFSPC	16.7			
56	Robins	AFMC	13.0			
57	Hill	AFMC	10.3			
58	Tinker	AFMC	10.0			
59	Wright-Patterson	AFMC	8.5			
60	Columbus	AETC	5.9			
61	Los Angeles	AFMC	5.1			
62	Brooks	AFMC	2.1			

NOTE: Data are only for major installations in the United States not slated for closure or major realignment with ADP slots in the FY95 CAIRS data.

Table A.10 presents a similar breakdown for RPM. There is more variability in the commands of the top and bottom installations than in Tables A.5 and A.9. As in Table A.9, AFSPC has bottom ten and top ten installations in both categories. AFSPC installations appear to be operated quite variably.

As a final example, Table A.11 presents the breakdown for social services. As in Tables A.5 and A.9, ACC installations are prominent in terms of use of military personnel. Meanwhile, there is minimal contractor participation in this area.

In an effort to formalize the intuition drawn from Tables A.7 through A.11, we undertook an analysis of installations' contractor, government-employed civilian, and military fractions in each function. For one

Table A.8

FY95 CAIRS Education and Training, Most and Least Proportional Use of Military and Contractor Labor

Rank	Installation	Command	Mil %	Installation	Command	CME %
1	Falcon	AFSPC	100	Kirtland	AFMC	46.6
2	Elmendorf	PACAF	100	Altus	AETC	43.2
3	Vance	AETC	98.3	Little Rock	ACC	38.4
4	Dyess	ACC	96.4	Holloman	ACC	29.0
5	Randolph	AETC	92.7	McChord	AMC	25.0
6	Tyndall	AETC	91.9	McGuire	AMC	22.5
7	Eielson	PACAF	91.7	Charleston	AMC	19.1
8	Laughlin	AETC	91.0	Columbus	AETC	14.5
9	Goodfellow	AETC	89.8	Davis-Monthan	ACC	14.4
10	Tinker	AFMC	88.7	Air Force Academy	NA	13.8
	Air Force average		69.8			8.2
53	Hill	AFMC	42.1	32 bases		0.0
54	Hanscom	AFMC	40.0			
55	Maxwell	AETC	39.2			
56	Wright-Patterson	AFMC	38.7			
57	Patrick	AFSPC	37.5			
58	Malmstrom	AFSPC	33.3			
59	Robins	AFMC	30.5			
60	Francis E. Warren	AFSPC	25.0			
61	Air Force Academy	NA	6.2			
62	MacDill	ACC	0.0			

NOTE: Data are only for major installations in the United States not slated for closure or major realignment with education and training slots in the FY95 CAIRS data.

approach, we undertook an arcsin regression analysis of these data. With an arcsin regression analysis, one transforms the dependent variable, the contractor, government-employed civilian, or military proportion, by taking its square root and then taking the inverse sine (arcsin) and using that transformation as the dependent variable. The new dependent variable is arcsin $\sqrt{\text{proportion}}$. Regular linear regression then proceeds after the transformation. Snedecor and Cochran (1967), pp. 327–329, and Bishop, Fienberg, and Holland (1975), pp. 367–368, discuss the arcsin transformation.

Table A.12 presents the arcsin regression results for the contractor fraction. Table A.13 presents the associated analysis of covariance-generated arcsin

Table A.9

FY95 CAIRS Installation Services, Most and Least Proportional Use of Military and Contractor Labor

Rank	Installation	Command	Mil %	Installation	Command	CME %
1	Dyess	ACC	85.5	Vance	AETC	92.5
2	Barksdale	ACC	84.4	Los Angeles	AFMC	88.8
3	Pope	ACC	84.3	Sheppard	AETC	78.1
4	Hurlburt Field	AFSOC	84.2	Patrick	AFSPC	62.3
5	Holloman	ACC	84.0	Lackland	AETC	61.4
6	Whiteman	ACC	82.6	Peterson	AFSPC	52.4
7	Grand Forks	AMC	82.4	Vandenberg	AFSPC	51.1
8	Little Rock	ACC	82.2	Keesler	AETC	46.7
9	Dover	AMC	82.0	Robins	AFMC	42.2
10	Malmstrom	AFSPC	81.4	Maxwell	AETC	41.7
	Air Force average		53.0			29.0
54	Vandenberg	AFSPC	38.0	Whiteman	ACC	6.9
55	Hill	AFMC	37.7	McGuire	AMC	6.7
56	Keesler	AETC	34.9	Francis E. Warren	AFSPC	6.7
57	Patrick	AFSPC	26.9	Eielson	PACAF	6.4
58	Lackland	AETC	26.1	Davis-Monthan	ACC	6.2
59	Wright-Patterson	AFMC	25.8	Tyndall	AETC	4.8
60	Sheppard	AETC	13.9	Holloman	ACC	4.2
61	Air Force Academy	NA	12.8	MacDill	ACC	3.1
62	Los Angeles	AFMC	7.3	Hickam	PACAF	2.7
63	Vance	AETC	6.5	Dover	AMC	2.7

NOTE: Data are only for major installations in the United States not slated for closure or major realignment with Installation Services slots in the FY95 CAIRS data.

means and Tukey-Kramer adjusted standard error estimates. Pearce (1982) describes analysis of covariance. Arcsin means, as shown in Table A.13, are estimates of the means that would be expected had other dummy variables been balanced in their frequency. They do not necessarily correspond in magnitude to sample means in the data. (See SAS Institute, 1990b, Volume 2, pp. 908 and 948.) Tukey-Kramer standard errors, meanwhile, are designed for pairwise comparisons. Two means in Table A.13 are significantly different at the 95-percent confidence level if one adjusted standard error below the larger is larger than one adjusted standard error above the smaller. (See Miller, 1985.)

Table A.10

FY95 CAIRS RPM, Most and Least Proportional Use of Military and Contractor Labor

Rank	Installation	Command	Mil %	Installation	Command	CME %
1	Hurlburt Field	AFSOC	61.2	Los Angeles	AFMC	100
2	Travis	AMC	57.7	Little Rock	ACC	72.1
3	Grand Forks	AMC	56.1	Patrick	AFSPC	53.5
4	Whiteman	ACC	54.3	Andrews	AMC	52.9
5	Francis E. Warren	AFSPC	51.0	Elmendorf	PACAF	47.1
6	Robins	AFMC	49.9	Hill	AFMC	46.7
7	MacDill	ACC	49.5	Moody	ACC	45.2
8	Dover	AMC	49.2	Falcon	AFSPC	44.9
9	Hanscom	AFMC	47.3	Vandenberg	AFSPC	43.4
10	Malmstrom	AFSPC	46.6	Sheppard	AETC	38.9
	Air Force average		31.5			28.6
53	Moody	ACC	22.6	Hurlburt Field	AFSOC	13.4
54	Wright-Patterson	AFMC	22.5	Francis E. Warren	AFSPC	12.6
55	Patrick	AFSPC	22.0	Whiteman	ACC	9.6
56	Andrews	AMC	21.9	Tinker	AFMC	9.5
57	Randolph	AETC	19.1	Hanscom	AFMC	2.7
58	Lackland	AETC	17.5	Brooks	AFMC	2.6
59	Little Rock	ACC	16.3	Holloman	ACC	2.5
60	Brooks	AFMC	7.7	Travis	AMC	0.7
61	Goodfellow	AETC	1.6	Hickam	PACAF	0.0
62	Los Angeles	AFMC	0.0	Lackland	AETC	0.0

NOTE: Data are only for major installations in the United States not slated for closure or major realignment with RPM slots in the FY95 CAIRS data.

Contracting is most prominent at AFMC, AFSPC, and, to a lesser extent, AETC installations, controlling for function. Contracting is most prominent by function in R&D support and other nonmanufacturing and particularly rare in social services, controlling for installations' commands. Of course, this social service finding accords closely with Table A.11.[1]

Table A.14 presents the arcsin regression results for the fraction of slots held by government-employed civilians. Table A.15 presents the arcsin means and adjusted standard errors.

Table A.14 suggests that government-employed civilians are least prominent at ACC installations, controlling for function. Government-employed civilians have predominant positions in depot repair, social services, and RPM.

[1]Peterson and O'Meara (1996), p. 10, notes that social services initiatives have been plagued by single-bidder problems. This may, in part, explain the comparative scarcity of contractors in this function.

Table A.11

FY95 CAIRS Social Services, Most and Least Proportional Use of Military and Contractor Labor

Rank	Installation	Command	Mil %	Installation	Command	CME %
1	Barksdale	ACC	56.2	Moody	ACC	19.4
2	Dyess	ACC	55.7	Hanscom	AFMC	15.0
3	Eielson	PACAF	54.7	Peterson	AFSPC	11.1
4	McConnell	AMC	53.8	Holloman	ACC	7.5
5	Vance	AETC	50.0	Goodfellow	AETC	4.7
6	Fairchild	AMC	49.4	Ellsworth	ACC	4.3
7	Ellsworth	ACC	49.3	Eglin	AFMC	3.3
8	Beale	ACC	48.4	Patrick	AFSPC	2.5
9	Seymour Johnson	ACC	47.5	Edwards	AFMC	2.2
10	Davis-Monthan	ACC	46.9	Scott	AMC	2.1
	Air Force average		33.8			1.7
53	Scott	AMC	26.6	51 bases		0.0
54	Kirtland	AFMC	25.8			
55	Maxwell	AETC	25.7			
56	Hickam	PACAF	23.0			
57	Edwards	AFMC	22.5			
58	Tinker	AFMC	21.7			
59	Brooks	AFMC	21.1			
60	Robins	AFMC	19.0			
61	Wright-Patterson	AFMC	8.8			
62	Air Force Academy	NA	6.4			

NOTE: Data are only for major installations in the United States not slated for closure nor major realignment with social services slots in the FY95 CAIRS data.

Finally, Table A.16 presents the arcsin regression results for the military fraction, while Table A.17 presents the arcsin means and adjusted standard errors.

Table A.16 suggests that military labor is disproportionately used at ACC installations, controlling for function, and disproportionately unused at AFMC installations. Controlling for command, in these data, military labor is most prominent in health services and intermediate maintenance and least prominent in depot repair, R&D support, RPM, and social services.

To test the robustness of the results of Tables A.12 through A.17, we also undertook a Tobit analysis. Tobit estimation makes a different

Table A.12

Contractor Fraction, Arcsin Regression

Dependent Variable	Arcsin $\sqrt{\text{contractor proportion}}$			
R^{2a}	0.3951			
Observations	506			
				F[b]
Analysis of variance	df	Sum of Squares	Mean Square	22.912
Regression	14	22.20131	1.58581	
residual	491	33.98356	0.06921	Significance F
Total	505	56.18486		0.0001

	Coefficient	Standard Error	t Statistic	P value[c]
Intercept	0.446094	0.05216410	8.552	0.0001
ACC	0.027588	0.04691415	0.588	0.5568
AETC	0.126916	0.04960591	2.558	0.0108
AMC	0.046631	0.05085386	0.917	0.3596
AFMC	0.237944	0.05033742	4.727	0.0001
AFSPC	0.189114	0.05590923	3.383	0.0008
ADP	–0.162691	0.04783670	–3.401	0.0007
DEPOT	–0.304501	0.10594154	–2.874	0.0042
EDUCAT	–0.375717	0.04804490	–7.820	0.0001
HEALTH	–0.433259	0.04783864	–9.057	0.0001
INSTALL	–0.081990	0.04763693	–1.721	0.0859
IMAINT	–0.295704	0.04783697	–6.181	0.0001
R&D	0.086086	0.07178563	1.199	0.2310
RPM	–0.021210	0.04783670	–0.443	0.6577
SOCIAL	–0.501928	0.04783864	–10.492	0.0001

[a]R^2 is a measure of regression goodness-of-fit. If the independent variables explained all variance in the dependent variable, the R-squared would be 1. In this case, the independent variables explain about 40 percent of the variance in the dependent variable.

[b]The regression F statistic is a test of the null hypothesis that all the regression coefficients, except the intercept, are actually zero. In this case, the F statistic of 22.912 is sufficiently large that we can reject the null that all the nonintercept coefficients are zero at an extremely high confidence level.

[c]The t statistic measures the statistical significance of the coefficient estimate, i.e., can we reject a null hypothesis that the coefficient is actually zero? The P value column in this case shows we cannot reject a null that the ACC coefficient, for instance, is zero at the 95-percent level, but we can reject a null that the AETC dummy variable coefficient is zero at the 95-percent confidence level.

distributional assumption than the preceding arcsin estimation. Cramer (1986) discusses Tobit estimation.

Table A.18 presents the Tobit results where the dependent variable is the contractor fraction in a function at an installation. There are no meaningful coefficient differences between Tables A.12 and Table A.18.

Table A.13

Contractor Fraction, Arcsin Least-Squares Means and Tukey-Kramer Adjusted Standard Errors

Variable Name	Arcsin Mean	Tukey-Kramer Adjusted Std Error
ACC	0.26459150	0.02408651
AETC	0.36391956	0.02949913
AFMC	0.47494729	0.02802152
AMC	0.28363391	0.03153489
AFSPC	0.42611763	0.03819897
Other commands	0.23700315	0.04314509
ADP	0.38810212	0.03435566
DEPOT	0.24629289	0.10059714
EDUCAT	0.17507687	0.03472894
HEALTH	0.11753419	0.03441528
INSTALL	0.46880378	0.03408788
IMAINT	0.25508986	0.03436854
Other nonmanufacturing	0.55079351	0.03408788
R&D	0.63687956	0.06332316
RPM	0.52958374	0.03435566
SOCIAL	0.04886520	0.03441528

Every independent variable that is significant in one is significant in the other, and conversely.

Table A.19 presents the Tobit estimates for the government-employed civilian fraction. In contrast to Table A.14, AMC and AFSPC installations are estimated to have statistically significantly less government-employed civilian participation than "other" major commands. One sees negative, but insignificant, estimates of these variables in Table A.14.

Finally, Table A.20 presents the Tobit estimates for the contractor fraction. Again, there are no meaningful differences between the results in Tables A.16 and A.20. The arcsin and Tobit analyses give essentially consistent findings.

In a final examination of these data, we undertook a multinomial logit estimation. A multinomial logit estimation is different from the arcsin and Tobit estimations in that it accounts for the fact that the data form a system, i.e., the contractor, civilian, and military fractions sum to 1 for every function at every installation. At the same time, multinomial logit makes certain assumptions about the data, e.g., extreme value distributed-error terms, that may be undesirable. Also, multinomial logit assumes

Table A.14

Government-Employed Civilian Fraction, Arcsin Regression

Dependent Variable:	Arcsin $\sqrt{\text{military proportion}}$			
R^2	0.5140			
Observations	506			
				F
Analysis of variance	df	Sum of Squares	Mean Square	37.099
Regression	14	21.04131	1.50295	
Residual	491	19.89117	0.04051	Significance F
Total	505	40.93248		0.0001

	Coefficient	Standard Error	t Statistic	P value
Intercept	0.437577	0.03990869	10.964	0.0001
ACC	–0.103522	0.03589216	–2.884	0.0041
AETC	–0.019982	0.03795152	–0.527	0.5988
AMC	–0.061360	0.03890628	–1.577	0.1154
AFMC	0.029002	0.03851117	0.753	0.4518
AFSPC	–0.082518	0.04277394	–1.929	0.0543
ADP	0.006519	0.03659797	0.178	0.8587
DEPOT	0.629827	0.08105168	7.771	0.0001
EDUCAT	0.107188	0.03675725	2.916	0.0037
HEALTH	–0.007699	0.03659945	–0.210	0.8335
INSTALL	0.013580	0.03644513	0.373	0.7096
IMAINT	–0.118174	0.03659817	–3.229	0.0013
R&D	0.036401	0.05492035	0.663	0.5078
RPM	0.260540	0.03659797	7.119	0.0001
SOCIAL	0.526949	0.03659945	14.398	0.0001

independence of irrelevant alternatives (IIA). (See, for example, Amemiya, 1985, pp. 296–299.) IIA asserts that, if we observe an installation spreading its workload in a function equally across the three options, removal of one choice would result in the workload being split equally between the other two options. This assumption may not be appropriate. In any case, we present multinomial logit results as a complement to the arcsin and Tobit results. We are largely agnostic as to which specification is most appropriate.

Table A.21 presents the multinomial logit marginal effect estimates associated with the three types of labor. In every case, the multinomial logit marginal effect estimates have the same sign as the arcsin and Tobit coefficient estimates. However, fewer of the multinomial logit coefficients are statistically significant.

Table A.15

Government-Employed Civilian Fraction, Arcsin Least-Squares Means and Tukey-Kramer Adjusted Standard Errors

Variable Name	Arcsin Mean	Tukey-Kramer Adjusted Std Error
ACC	0.47956821	0.01842764
AETC	0.56310815	0.02256862
AFMC	0.61209201	0.02143816
AMC	0.52172975	0.02412610
AFSPC	0.50057134	0.02922452
Other commands	0.58308979	0.03300860
ADP	0.40436542	0.02628416
DEPOT	1.02767351	0.07696289
EDUCAT	0.50503519	0.02656974
HEALTH	0.39014777	0.02632977
INSTALL	0.41142734	0.02607929
IMAINT	0.27967276	0.02629401
Other nonmanufacturing	0.39784686	0.02607929
R&D	0.43424750	0.04844604
RPM	0.65838664	0.02628416
SOCIAL	0.92479578	0.02632977

In the presentation, we discussed the arcsin coefficient estimates. This choice was made based on the fact that the arcsin R^2 statistic is the most intuitive measure of estimation goodness-of-fit associated with these three estimation techniques. We present the Tobit and multinomial logit results in this appendix as well, however, for the reader who has different views as to the appropriate estimation strategy.

The arcsin R^2 statistics are revealing because they suggest these command- and function-based estimations are not the complete story. The arcsin R^2 statistics in Tables A.14 and A.16 are just over 50 percent while Table A.12's R^2 is less than 40 percent. There is a great deal of variance that is not explained by installation command or function dummy variables.

Table A.16

Military Fraction, Arcsin Regression

Dependent Variable:	Arcsin $\sqrt{\text{military proportion}}$			
R^2	0.5135			
Observations	506			
				F
Analysis of variance	df	Sum of Squares	Mean Square	37.014
Regression	14	28.23990	2.01714	
Residual	491	26.75777	0.05450	Significance F
Total	505	54.99766		0.0001

	Coefficient	Standard Error	t Statistic	P Value
Intercept	0.856977	0.04628734	18.514	0.0001
ACC	0.092403	0.04162885	2.220	0.0269
AETC	–0.070273	0.04401735	–1.596	0.1110
AMC	0.043949	0.04512471	0.974	0.3306
AFMC	–0.214852	0.04466645	–4.810	0.0001
AFSPC	–0.069214	0.04961054	–1.395	0.1636
ADP	0.068084	0.04244746	1.604	0.1094
DEPOT	–0.478756	0.09400626	–5.093	0.0001
EDUCAT	0.145704	0.04263220	3.418	0.0007
HEALTH	0.325222	0.04244918	7.661	0.0001
INSTALL	0.069696	0.04227020	1.649	0.0998
IMAINT	0.305582	0.04244770	7.199	0.0001
R&D	–0.260486	0.06369833	–4.089	0.0001
RPM	–0.203193	0.04244746	–4.787	0.0001
SOCIAL	–0.195171	0.04244918	–4.598	0.0001

Table A.17

Military Fraction, Arcsin Least-Squares Means and Tukey-Kramer Adjusted Standard Errors

Variable Name	Arcsin Mean	Tukey-Kramer Adjusted Std. Error
ACC	0.92704745	0.02137294
AETC	0.76437165	0.02617579
AFMC	0.61979218	0.02486464
AMC	0.87859347	0.02798220
AFSPC	0.76543058	0.03389551
Other commands	0.83464466	0.03828440
ADP	0.88872916	0.03048518
DEPOT	0.34188913	0.08926395
EDUCAT	0.96634872	0.03081641
HEALTH	1.14586711	0.03053808
INSTALL	0.89034153	0.03024757
IMAINT	1.12622738	0.03049661
Other nonmanufacturing	0.82064517	0.03024757
R&D	0.56015908	0.05618923
RPM	0.61745177	0.03048518
SOCIAL	0.62547428	0.03053808

Table A.18

Contractor Fraction, Tobit Estimation

Dependent Variable:	Proportion of Slots Held by Contractors			
Noncensored Observations	370			
Left Censored Observations	134			
Right Censored Observations	2			
	Coefficient	Standard Error	Chi-Squared Statistic	P value[a]
Intercept	0.1925068	0.048191	15.9571	0.0001
ACC	0.0351628	0.045110	0.6076	0.4357
AETC	0.1210801	0.047346	6.5400	0.0105
AMC	0.0475243	0.048598	0.9563	0.3281
AFMC	0.2320108	0.047737	23.6210	0.0001
AFSPC	0.1835259	0.052515	12.2130	0.0005
ADP	–0.1237444	0.042334	8.5442	0.0035
DEPOT	–0.2669435	0.100687	7.0289	0.0080
EDUCAT	–0.3249880	0.044289	53.8443	0.0001
HEALTH	-0.3170338	0.042371	55.9861	0.0001
INSTALL	–0.0679237	0.041057	2.7369	0.0981
IMAINT	–0.2045019	0.041548	24.2266	0.0001
R&D	0.0828388	0.063525	1.7005	0.1922
RPM	–0.0270788	0.041315	0.4296	0.5122
SOCIAL	–0.5467626	0.054270	101.5029	0.0001

[a]The Chi-squared statistic measures the statistical significance of the coefficient estimate, i.e., can we reject a null hypothesis that the coefficient is actually zero? The P value column in this case shows we cannot reject a null that the ACC coefficient, for instance, is zero at the 95-percent level, but we can reject a null that the AFMC coefficient is zero at the 99.99-percent confidence level.

Table A.19

Government-Employed Civilian Fraction, Tobit Estimation

Dependent Variable:	Proportion of Slots Held by Contractors			
Noncensored Observations	488			
Left Censored Observations	14			
Right Censored Observations	4			
	Coefficient	Standard Error	Chi-Squared Statistic	P value
Intercept	0.2025506	0.030190	45.01297	0.0001
ACC	–0.0910613	0.027175	11.22870	0.0008
AETC	–0.0217797	0.028742	0.57420	0.4486
AMC	–0.0630335	0.029442	4.58354	0.0323
AFMC	0.0220159	0.029165	0.56983	0.4503
AFSPC	–0.0715256	0.032454	4.85719	0.0275
ADP	0.0137647	0.027684	0.24722	0.6190
DEPOT	0.5015331	0.062380	64.64186	0.0001
EDUCAT	0.0993506	0.027780	12.79030	0.0003
HEALTH	–0.0124052	0.027642	0.20140	0.6536
INSTALL	0.0058735	0.027506	0.04560	0.8309
IMAINT	–0.0507953	0.027724	3.35697	0.0669
R&D	0.0506499	0.041758	1.47125	0.2251
RPM	0.2148129	0.027629	60.44753	0.0001
SOCIAL	0.4679504	0.027622	286.99560	0.0001

Table A.20

Military Fraction, Tobit Estimation

Dependent Variable:	Proportion of Slots Held by Military			
Noncensored Observations	497			
Left Censored Observations	6			
Right Censored Observations	3			
	Coefficient	Standard Error	Chi-Squared Statistic	P value
Intercept	0.5624057	0.038043	218.5501	0.0001
ACC	0.0868367	0.034242	6.4312	0.0112
AETC	–0.0541726	0.036194	2.2402	0.1345
AMC	0.0523172	0.037101	1.9885	0.1585
AFMC	–0.1809350	0.036761	24.2253	0.0001
AFSPC	–0.0581543	0.040850	2.0266	0.1546
ADP	0.0579774	0.034833	2.7703	0.0960
DEPOT	–0.3737596	0.081170	21.2026	0.0001
EDUCAT	0.1249493	0.035010	12.7376	0.0004
HEALTH	0.2846255	0.034868	66.6337	0.0001
INSTALL	0.0632675	0.034688	3.3266	0.0682
IMAINT	0.2371856	0.034851	46.3178	0.0001
R&D	–0.1931149	0.052435	13.5641	0.0002
RPM	–0.1917088	0.034863	30.2383	0.0001
SOCIAL	–0.1889726	0.034835	29.4285	0.0001

Table A.21

Multinomial Logit Estimation

	Coefficient	Standard Error	t Statistic	P value
Category: Fraction of Slots Held by Contractors				
ACC	0.03606	0.05874	0.061	0.95105
AETC	0.06690	0.06186	1.082	0.27947
AMC	0.09969	0.06326	0.158	0.87478
AFMC	0.12511	0.06659	1.879	0.06028
AFSPC	0.09829	0.06776	1.450	0.14693
ADP	–0.03996	0.04298	–0.930	0.35253
DEPOT	–0.02367	0.11432	–0.207	0.83597
EDUCAT	–0.17593	0.07556	–2.328	0.01989
HEALTH	–0.29798	0.13833	–2.154	0.03123
INSTALL	–0.03599	0.04237	–0.849	0.39563
IMAINT	–0.12392	0.06068	–2.042	0.04114
R&D	0.04596	0.05782	0.795	0.42672
RPM	–0.00010	0.04072	–0.003	0.99795
SOCIAL	–0.31980	0.17181	–1.861	0.06270
Category: Fraction of Slots Held by Government-Employed Civilians				
ACC	–0.11056	0.08397	–1.317	0.18794
AETC	–0.01772	0.08523	–0.208	0.83531
AMC	–0.07359	0.08952	–0.822	0.41104
AFMC	0.05345	0.08627	0.620	0.53551
AFSPC	–0.06641	0.10019	–0.663	0.50742
ADP	0.00856	0.09394	0.091	0.92738
DEPOT	0.46725	0.20616	2.266	0.02343
EDUCAT	0.09641	0.09060	1.064	0.28726
HEALTH	–0.01593	0.09880	–0.161	0.87191
INSTALL	–0.06602	0.09471	–0.070	0.94443
IMAINT	–0.10093	0.10493	–0.962	0.33614
R&D	0.14270	0.13815	1.033	0.30164
RPM	0.23623	0.09384	2.517	0.01182
SOCIAL	0.41729	0.10483	3.981	0.00007
Category: Fraction of Slots Held by Military				
ACC	0.10696	0.09154	1.168	0.24262
AETC	–0.04918	0.09539	–0.516	0.60615
AMC	0.06362	0.09863	0.645	0.51890
AFMC	–0.17856	0.10025	–1.781	0.07489
AFSPC	–0.03188	0.10914	–0.292	0.77022
ADP	0.03140	0.09617	0.326	0.74408
DEPOT	–0.44358	0.26551	–1.671	0.09479
EDUCAT	0.07952	0.09717	0.818	0.41313
HEALTH	0.31391	0.11395	2.755	0.00587
INSTALL	0.04260	0.09658	0.441	0.65917
IMAINT	0.22485	0.10628	2.116	0.03438
R&D	–0.18865	0.15415	–1.224	0.22100
RPM	–0.23613	0.09613	–2.456	0.01404
SOCIAL	–0.09749	0.11075	–0.880	0.37872

Appendix B

AN ANALYSIS OF THE AIR FORCE CAMIS DATA SET

The Air Force maintains CAMIS at AFMEA, at Randolph AFB. We obtained a copy of CAMIS from AFMEA. The data were current as of July 1, 1996.

The CAMIS data we obtained track and record information about A-76 government-contractor cost comparisons and direct conversions to contractors in the Air Force dating back to FY78. A-76 is the OMB circular describing the process by which government employees and contractors compete for the opportunity to provide a service on an installation. With a direct conversion, by contrast, government employees do not compete for the opportunity to provide a service. Chapter 12 of Air Force Pamphlet 26-12, September 25, 1992, discusses conditions for direct conversions. Installation commanders may approve conversions of an in-house activity directly to contract, without a cost comparison, under a variety of circumstances; e.g., if it is currently performed by ten or fewer government-employed civilians. We refer to either type of approach as an *initiative*.

A CAMIS record is set up any time a function is nominated for potential outsourcing. Most, but not all, initiatives in CAMIS involve a single installation. There are 14 observations in the data of completed multiple-installation initiatives, most involving simulator maintenance and radar.

Various milestones are tracked in CAMIS. Data are recorded on the type of function involved, the initiative approach (e.g., sealed bid, negotiated), the winner of the initiative, the dollars involved, and many other characteristics of the process. There is also limited tracking of postaward costs, but such tracking is not a primary purpose of this system, it appears.

Not all initiatives that were started were completed. Indeed, as shown in Table B.1, approximately three initiatives have been canceled in the Air Force for every seven completed. Table B.2 also shows that the number of cost comparisons started has diminished sharply since a peak in the early 1980s, although there has been an upturn recently.

Table B.2 shows the current status of initiatives by command. ACC has started and completed the most initiatives.

Table B.1

Status of Air Force Initiatives, Fiscal Year Started

FY Start	Completed	Canceled	In Progress
1978	57	20	0
1979	207	31	0
1980	18	3	0
1981	64	49	0
1982	154	94	0
1983	162	34	0
1984	162	102	0
1985	24	11	0
1986	119	29	0
1987	42	9	0
1988	8	15	0
1989	23	32	0
1990	37	11	0
1991	13	21	0
1992	20	21	1
1993	10	4	1
1994	20	4	1
1995	5	2	20
1996	2	2	80
Total	1,147	494	103

NOTE: Data as of July 1, 1996.

Table B.2

Air Force Initiative Status by Command

Service	Completed	Canceled	In Progress
AFMC	160	100	18
ACC	306	123	31
AETC	243	73	13
AMC	135	53	5
AFSPC	50	17	0
Other	253	128	36
Total	1,147	494	103

NOTE: Data as of July 1, 1996.

In light of the obvious cost of initiative cancellation, we ran a probit estimation to see if there have been patterns in the sorts of initiatives that have been canceled and the sorts completed. (Probit estimation is akin to linear regression but more appropriate in a case like this with a dichotomous dependent variable. See, for example, Cramer, 1989.) Table B.3 lists the independent variables we used. All independent variables,

Table B.3

Air Force CAMIS Probit Variables

Dependent Variable	1 if Initiative Completed, 0 if Canceled
Independent Variables	Variable Name
Constant	
Square Root of Number of Military Slots Evaluated	SQRTMILS
Square Root of Number of Civilian Slots Evaluated	SQRTCIVS
Multi-function Initiative[a]	MULTI
Air Combat Command Initiative	ACC
Air Education and Training Command Initiative	AETC
Air Mobility Command Initiative	AMC
Air Force Materiel Command Initiative	AFMC
Space Command Initiative[b]	AFSPC
Automatic Data Processing	ADP
Base Maintenance	BASEMAIN
Education and Training	EDUCAT
Health Services	HEALTH
Installation Services	INSTALL
Intermediate Maintenance	IMAINT
Research & Development support	R&D
Real Property Maintenance	RPM
Social Services[c]	SOCIAL
FY78 or FY79 Initiative Start	FY7879
FY80 or FY81 Initiative Start	FY8081
FY82 or FY83 Initiative Start	FY8283
FY84 or FY85 Initiative Start	FY8485
FY86 or FY87 Initiative Start	FY8687
FY88 or FY89 Initiative Start	FY8889
FY90 or FY91 Initiative Start	FY9091
FY92 or FY93 Initiative Start[d]	FY9293
Direct Conversion[e]	DIRECT

[a]The omitted variable is single-function initiatives.

[b]The omitted variable is other commands' initiatives.

[c]The omitted variable is other nonmanufacturing.

[d]The omitted variable is initiatives started in FY 1994 or later.

[e]The omitted variable is A-76 cost comparison.

except the constant and the square roots of the number of military and civilian slots evaluated in the initiatives, are dummy variables. We took the square roots of the slot totals to reduce non-normality in these totals. Table B.3 groups the dummy variables into sets. The footnotes discuss the

omitted variable for each set. The function (e.g., ADP, base maintenance) is the first function listed in the CAMIS function field. Some initiatives involved more than one function. This analysis, however, only uses the first listed function. We omitted the 18 depot repair and the 12 manufacturing initiatives. The 18 depot repair initiatives were all canceled. Ten manufacturing initiatives were canceled; two were ongoing and were not considered. Given the lack of variance in their outcomes, we could not estimate coefficients for these functions.

Table B.4 presents our probit results. It suggests that multifunction initiatives have been more likely to be completed than single-function initiatives, controlling for other factors.

Among the commands, AETC has had the greatest success in completing their initiatives. Among the functions, social services, RPM, and installation services initiatives have been most likely to be completed. Education and training initiatives have been vulnerable to cancellation. As noted, too, all the Air Force's manufacturing and depot repair initiatives that were not ongoing were canceled.

Early comparisons were generally completed, but comparisons started in the late 1980s were particularly vulnerable to cancellation.

Direct conversions were statistically significantly more likely to be completed than A-76 cost comparisons, controlling for other factors.

Completed initiatives receive a dollar value, i.e., the value of the winning contractor or government employee (labeled "MEO") bid. CAMIS dollar totals are then-year; e.g., an initiative completed in 1982 has a dollar total in 1982 dollars. To compare completed initiatives over time, we standardized all initiative dollars to FY96 dollars. Table B.5 shows the multipliers we used to do this.

U.S. Department of Commerce (1992) and the *Economic Report of the President* (1996) provide first and second calendar quarter aggregate price indices for various years in 1987 and 1992 dollars, respectively. We assumed that the average of a calendar year's first and second quarter price indices is a reasonable price index for the corresponding fiscal year. (Fiscal years run October through September.) We used 1991 data to link the two price indices, i.e., to establish the correct relationship between 1987 and 1992 dollars. We assumed 3-percent inflation between FY 1995 and FY96. Through this process, we computed the FY96 Multiplier column shown in Table B.5. We multiplied all dollar totals in CAMIS by the appropriate multiplier for the fiscal year in which an initiative was completed. All dollar totals used in this analysis, therefore, are in FY96 dollars. Clearly, in particular for early initiatives, the FY96 dollar value is

Table B.4

Air Force Initiative Probit on Completion

Dependent Variable:	1 if Comparison Completed			
Observations	1613			
	Coefficient	Standard Error	Chi-Squared Statistic	P value
Intercept	–0.6080256	0.278132	4.7790	0.0288
SQRTMILS	–0.0287348	0.011946	5.7859	0.0162
SQRTCIVS	0.0392345	0.018110	4.6936	0.0303
MULTI	1.0178492	0.229150	19.7301	0.0001
ACC	0.4200185	0.124158	11.4443	0.0007
AETC	0.6909528	0.131614	27.5607	0.0001
AMC	0.3888000	0.150112	6.7085	0.0096
AFMC	0.3960500	0.140562	7.9390	0.0048
AFSPC	0.5924472	0.211612	7.8383	0.0051
ADP	0.0483472	0.281929	0.0294	0.8638
BASEMAIN	–0.8050777	0.320115	6.3250	0.0119
EDUCAT	–1.3961736	0.306522	20.7470	0.0001
HEALTH	0.3212306	0.227137	2.0001	0.1573
INSTALL	0.5719380	0.138250	17.1146	0.0001
IMAINT	0.1600016	0.126090	1.6102	0.2045
R&D	0.4643964	0.294821	2.4812	0.1152
RPM	0.5871977	0.115033	26.0569	0.0001
SOCIAL	1.0519623	0.172724	37.0934	0.0001
FY7879	0.9277975	0.265327	12.2276	0.0005
FY8081	0.3062307	0.274474	1.2448	0.2645
FY8283	0.3634346	0.257747	1.9882	0.1585
FY8485	–0.0068933	0.258883	0.0007	0.9788
FY8687	0.4138772	0.266985	2.4031	0.1211
FY8889	–0.7984904	0.287434	7.7173	0.0055
FY9091	–0.2502342	0.294713	0.7209	0.3958
FY9293	–0.5112694	0.301738	2.8710	0.0902
DIRECT	0.9949363	0.117636	71.5338	0.0001

considerably greater than the then-year nominal dollar value actually provided in CAMIS.

For the remainder of this appendix, we focus on completed initiatives only; i.e., a decision was made that either government employees or a specific contractor would perform the specified function. Initiatives that were started, but not completed, are ignored. Ongoing initiatives are also omitted. We also deleted nine records that indicated 0 dollars were involved, as well as a few other records with obvious problems.

Table B.5

FY96 Price Index Computation

	1987=100			1992=100			
FY	1st Q	2nd Q	Average	1st Q	2nd Q	Average	FY 1996 Multiplier
1979	63.5	64.8	64.2				2.06818
1980	69.2	70.8	70.0				1.89534
1981	76.5	77.9	77.2				1.71857
1982	82.3	83.4	82.8				1.60137
1983	86.0	86.6	86.3				1.53736
1984	89.7	90.6	90.2				1.47170
1985	93.3	94.0	93.6				1.41670
1986	96.0	96.5	96.2				1.37843
1987	98.8	99.5	99.2				1.33811
1988	102.1	103.2	102.6				1.29249
1989	106.9	108.0	107.4				1.23475
1990	111.1	112.3	111.7				1.18777
1991	115.9	116.8	116.4	96.3	97.0	96.6	1.14030
1992				99.1	99.8	99.4	1.10820
1993				101.8	102.4	102.1	1.07943
1994				104.1	104.6	104.4	1.05616
1995				106.7	107.3	107.0	1.03000
1996					Assume	110.2	1.00000

SOURCES: U.S. Department of Commerce (1992) and *Economic Report of the President* (1996).

In total, we were left with 1,092 completed Air Force initiatives in the data set.[1] Of these, 853 of these involved cost comparison between government employees and contractors, and 239 were direct conversions to contractor support.

Each CAMIS record also includes a DoDFAC, which categorizes the type of function competed. Table B.6 presents information about the completed initiatives by DoDFAC. Annualized dollars represent the FY96 total value of the initiative divided by its duration. As noted above, some CAMIS records listed multiple functions; we used the first listed function.

In annualized real dollars, other nonmanufacturing, intermediate maintenance, and installation services are the high dollar categories in these data. There have been more completed initiatives in RPM, installation services, and social services than in intermediate maintenance, but intermediate maintenance involves more money.

[1]Tables B.1 through B.4 covered 1,147 completed initiatives. However, we omitted 55 from further analysis, largely because of missing dates or omitted dollar values.

Table B.6

Air Force Completed Initiatives by DoD Functional Activity Code

DoDFAC	Total	A-76s	Government Employees Won	Direct Conversions	Annualized Dollars (000s)
ADP	14	11	4	3	24,514
Base maintenance	15	15	11	0	43,736
Education and training	4	1	0	3	2,807
Health services	30	21	13	9	12,349
Installation services	154	116	44	38	300,684
Intermediate maintenance	124	99	27	25	336,821
Other nonmanufacturing	351	225	101	136	469,031
R&D support	25	13	3	12	89,716
RPM	232	224	90	8	223,398
Social services	133	128	17	5	48,906
Total	1,092	853	310	239	1,549,036

NOTE: Data as of July 1, 1996.

It is also interesting to note that, whereas government employees have won 36 percent of the A-76 cost comparisons, their success rate varies considerably across the categories, e.g., 73 percent in base maintenance versus 13 percent in social services. Direct conversions are common in other nonmanufacturing (38 percent of the other nonmanufacturing initiatives), but rare in RPM (3 percent) and social services (4 percent).

Table B.7 shows that the biggest year for completion of A-76 cost comparisons, both in number and real dollar value, was FY81. There has been a distinct decline in A-76 activity in recent years. This decline probably emanates, at least in part, from the FY89 National Defense Authorization Act directive that installation commanders have the sole authority to determine which functions to cost compare or direct convert (10 U.S.C. 2468). (This stipulation expired September 30, 1995.) Installation commanders on comparatively short tours are often reluctant to undertake painful A-76 cost comparisons, even if such cost comparisons have long-term benefits.[2] Further, the FY93 DoD Authorization Act imposed a DoD-wide moratorium on awarding contracts resulting from cost comparisons that was in effect until April 1, 1994. Finally, it might be

[2]Bolten, Halliday, and Keating (1996) discusses this problem in the Army and presents some possible solutions, e.g., longer military tours or greater civilian control of installations.

Table B.7

Air Force Completed Initiatives by Fiscal Year

Fiscal Year	A-76	Annualized Dollars (000s)	Direct Conversion	Annualized Dollars (000s)
1979	53	91,363	0	0
1980	60	73,119	0	0
1981	121	292,608	0	0
1982	70	82,298	0	0
1983	71	35,928	0	0
1984	54	39,785	0	0
1985	60	51,297	2	123
1986	72	42,490	69	13,655
1987	97	90,457	52	39,984
1988	55	83,088	26	31,525
1989	32	45,383	13	5,558
1990	24	77,839	10	2,891
1991	50	47,788	26	14,492
1992	10	12,689	11	64,355
1993	2	2,100	16	9,492
1994	7	17,047	3	3,237
1995	7	10,238	7	110,629
1996	8	39,318	4	121,185
Total	853	1,134,835	239	417,126

NOTE: Data as of July 1, 1996.

that initiatives have diminished as obvious outsourcing opportunities have been, at least in part, handled.

Direct conversions started in the mid-1980s. FY86 was the year with the most completed direct conversions, but FY96 was most prominent in real dollar terms. On average, direct conversions have involved a greater number of real dollars per completed initiative than A-76 cost comparisons ($1.75 million annualized value per completed direct conversion versus $1.33 million annualized value per completed A-76 cost comparison).

Table B.8 presents the number and annualized dollar value of A-76 cost comparisons won by government employees and contractors. Overall, government employees won 36 percent of the A-76 cost comparisons covering 35 percent of the competed annualized FY96 dollar value.

Table B.9 tallies completed initiatives and annualized FY96 dollar value by major command and fiscal year. Both in number of completed initiatives

Table B.8

Completed A-76 Cost Comparison Outcomes by Fiscal Year

Fiscal Year	Government Employees Won	Annualized Dollars (000s)	Contractors Won	Annualized Dollars (000s)
1979	12	22,243	41	69,121
1980	20	24,980	40	48,139
1981	33	94,977	88	197,631
1982	29	24,670	41	57,628
1983	47	21,430	24	14,497
1984	23	16,726	31	23,059
1985	26	18,220	34	33,077
1986	22	20,181	50	22,309
1987	28	26,791	69	63,666
1988	11	11,630	44	71,458
1989	16	33,847	16	11,536
1990	9	17,564	15	60,275
1991	22	16,844	28	30,944
1992	3	3,676	7	9,013
1993	2	2,100	0	0
1994	1	1,981	6	15,066
1995	3	7,423	4	2,815
1996	3	33,905	5	5,413
Total	310	399,189	543	735,646

NOTE: Data as of July 1, 1996.

and real dollar value competed, ACC and AETC are most prominent. AFSPC's average completed initiative is somewhat larger than that of the other commands. Notice that, for every command, the standard deviation of completed initiative size is considerably greater than the mean completed initiative size. Completed initiatives vary greatly in size within commands.

The CAMIS system contains a variety of date stamps. The following are some of the dates tracked in CAMIS.

- Announcement date
- PWS start date
- PWS completion date
- Contract solicitation issue date
- Completion of in-house MEO bid date
- Bid opening date
- Award date
- MEO implementation date
- Contract start date

Table B.9

Completed Initiatives by Major Command and Fiscal Year

FY	ACC #	Annual Dollars (000s)	AETC #	Annual Dollars (000s)	AMC #	Annual Dollars (000s)	AFMC #	Annual Dollars (000s)	SPC #	Annual Dollars (000s)	Oth #	Annual Dollars (000s)
1979	6	5,517	9	19,607	7	2,784	16	32,378	2	20,519	13	10,559
1980	8	5,788	22	45,136	7	8,460	4	3,023	4	1,499	15	9,213
1981	35	107,211	17	42,498	13	15,157	14	95,377	6	7,870	36	24,495
1982	24	16,085	8	31,897	8	2,079	20	26,714	0	0	10	5,522
1983	11	3,356	21	7,417	10	2,772	17	14,930	2	324	10	7,129
1984	7	2,122	12	6,452	4	2,807	20	16,400	5	9,722	6	2,282
1985	12	12,886	9	8,137	11	5,915	14	14,420	6	4,932	10	5,131
1986	63	20,914	24	12,118	15	4,139	11	9,853	9	3,918	19	5,204
1987	49	47,328	35	15,408	20	28,268	9	4,403	4	20,263	32	14,772
1988	26	55,972	21	33,400	4	5,206	2	723	4	4,629	24	14,682
1989	7	7,454	8	22,225	8	2,169	8	8,824	1	503	13	9,766
1990	6	2,812	5	53,484	2	788	8	11,105	0	0	13	12,542
1991	17	20,709	20	7,917	8	6,231	6	11,683	5	7,182	20	8,558
1992	3	3,480	7	3,078	4	11,057	4	1,726	0	0	3	57,703
1993	8	6,898	3	609	5	3,247	1	324	1	514	0	0
1994	3	5,038	5	12,460	2	2,787	0	0	0	0	0	0
1995	5	109,100	2	1,679	2	1,053	1	2,385	1	3,455	3	3,196
1996	3	122,340	4	32,278	1	41	2	3,378	0	0	2	2,465
Total	293	555,009	232	355,798	131	104,960	157	257,646	50	85,330	229	193,219
Average		1,894		1,534		801		1,641		1,707		844
Std Dev		10,264		3,685		2,106		2,782		2,573		3,700

NOTE: Data as of July 1, 1996.

Unfortunately, there are a considerable number of missing values in the CAMIS date fields. Some of these missing dates are obvious, e.g., a contract start date only occurs if a contractor is chosen. Other date fields, however, are often simply empty, e.g., hundreds of records are missing either a PWS start or completion date or both. A further complication is that, although the order presented in this list is the modal order for dates to occur, there are many cases where dates do not sequence in that manner.

Section 8020 of the FY91 Appropriation Act instructed the Air Force to track the duration of its initiatives from the announcement date to the bid opening date. Using this definition, single-function initiatives not completed within two years were to be canceled. As a first-duration analysis, then, we analyzed the duration of the completed Air Force initiatives using this definition.

Unfortunately, announcement and bid opening dates are often missing in CAMIS records. Hence, we could not use the 1,092 initiative completions analyzed previously. Instead, only 927 could be used in an analysis of duration patterns.

Table B.10 presents some basic statistics describing duration in these data. The median initiative took about a year-and-a-half from announcement to bid opening. The mean duration exceeds two years.

A key question we wished to evaluate was why the duration of the process in these data has been typically so lengthy and also so highly variable, as shown in Table B.10. As a first step toward answering this question, we regressed the square root of observed duration, as we defined it, on a variety of possible explanatory variables. We took the square root of duration as the dependent variable to adhere more closely to the normality assumption required for linear regression. Table B.11 presents our basic regression variables. All independent variables except the constant, the square root of annualized FY96 dollars involved, and the square roots of the number of military and civilian slots evaluated in the initiative are dummy variables. Table B.11 groups the dummy variables into sets. The footnotes discuss the omitted variable for each set.

Table B.10

Completed Initiative Duration Summary

	#	Min	5%	25%	Med	Mean	75%	95%	Max
Duration (Days)	927	5	215	422	567	757	992	1818	3332

Table B.11

Air Force CAMIS Regression Variables

Dependent Variable	Square Root of Duration (Days)
Independent Variables	Variable Name
Constant	
Square Root of Annualized FY96 Dollars Involved	SQRTANMO
Square Root of Number of Military Slots Evaluated	SQRTMILS
Square Root of Number of Civilian Slots Evaluated	SQRTCIVS
Multi-Function Initiative[a]	MULTI
Air Combat Command Initiative	ACC
Air Education and Training Command Initiative	AETC
Air Mobility Command Initiative	AMC
Air Force Materiel Command Initiative	AFMC
Space Command Initiative[b]	AFSPC
Automatic Data Processing	ADP
Base Maintenance	BASEMAIN
Education and Training	EDUCAT
Health Services	HEALTH
Installation Services	INSTALL
Intermediate Maintenance	IMAINT
Research & Development Support	R&D
Real Property Maintenance	RPM
Social Services[c]	SOCIAL
FY 1979-1981 Initiative Completion	EARLY
FY 1982-1984 Initiative Completion	EMID
FY 1985-1987 Initiative Completion	LMID
FY 1988-1990 Initiative Completion	LATE
FY 1991-1993 Initiative Completion[d]	RECENT
Sealed Bid[e]	SEALED
Unrestricted Initiative[f]	UNRESTRICTED
Direct Conversion[g]	DIRECT

[a]The omitted variable is single-function initiatives.

[b]The omitted variable is other commands' initiatives.

[c]The omitted variable is other nonmanufacturing.

[d]The omitted variable is initiatives completed in FY 1994 or later.

[e]The omitted variable is negotiated contracts.

[f]The omitted variable is other types of initiatives, e.g., restricted to small or disadvantaged businesses.

[g]The omitted variable is A-76 cost comparison.

Table B.12 presents our regression results. Table B.13, meanwhile, presents analysis of covariance-generated means and Tukey-Kramer adjusted standard error estimates for the typical values of some of the dummy variable categories.

The independent variables in Table B.12 only explain about 40 percent of the variance in the data. The initiative process is not only lengthy, but subject to variation not captured by the explanatory variables we have used.

Tables B.12 and B.13 suggest the contracting initiative process slowed considerably in the late 1980s. However, this finding may be spurious. Initiatives only started in earnest in the late 1970s; so, by definition, any initiatives completed in the late 1970s or early 1980s had to be rapid. In the mid- and late 1980s, many lengthy initiatives started in the late 1970s and early 1980s were completed.

There is some suggestion that the initiative process has sped up in recent years. Initiatives completed in FY94 and later are the omitted time period in Table B.12. Hence, we see the appearance of a negative duration trend with initiatives completed in FY88 thru FY90 typically taking an estimated 475 days longer than initiatives completed in FY94 and later, while initiatives completed in FY91 through FY93 typically took an estimated 280 days longer than initiatives completed in FY94 and later. One possible explanation is the policy first promulgated in Section 8020 of the FY91 Appropriations Act of canceling single-function initiatives after two years and multifunction initiatives after four years if they have not yet reached bid opening. The policy may be speeding initiatives or, referring to Table B.4, perhaps this apparent speed increase may be partially a data censoring caused by cancellation of more initiatives.

Table B.12 estimates that direct conversions typically take 200 fewer days to complete than A-76 cost comparisons, other factors held constant.[3] This result is statistically significant at the 99-percent confidence level. Recall, too, that Table B.4 suggests A-76 cost comparisons were significantly more likely to be canceled than direct conversions. On the other hand, even if government-contractor comparisons are omitted, the initiative process would still likely last well in excess of one year. Table B.12, after all, suggests that the current process typically has taken in excess of 550 calendar days, or a year-and-a-half.

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[3]This result is somewhat at odds with Andrews' (1996), Attachment 1, p. 2, assertion that "A-76 policies and legislation impacting A-76 *DO NOT* slow down AF outsourcing," although Andrews' analysis addresses the A-76 process over the last 10 years rather than from FY79.

Table B.12

Air Force Initiatives, Duration Linear Regression

Dependent Variable	Square Root of Duration			
R-squared	0.4069			
Observations	927			
				F
Analysis of variance	df	Sum of Squares	Mean Square	23.749
Regression	26	28222.44777	1085.47876	
Residual	900	41135.57965	45.70620	Significance F
Total	926	69358.02742		0.0001

	Coefficient	Standard Error	t Statistic	P value
Intercept	27.831124	1.5280246	18.214	0.0001
SQRTANMO	–0.009298	0.0111920	–0.831	0.4063
SQRTMILS	–0.001610	0.0858907	–0.019	0.9852
SQRTCIVS	0.152014	0.1122831	1.354	0.1761
MULTI	0.587947	0.9484082	0.620	0.5355
ACC	0.296372	0.9206786	0.322	0.7476
AETC	–2.882080	0.9296633	–3.100	0.0020
AMC	0.482111	1.0153008	0.475	0.6350
AFMC	–1.445603	0.9787985	–1.477	0.1400
AFSPC	–1.621110	1.2953516	–1.251	0.2111
ADP	–4.318772	1.9451398	–2.220	0.0266
BASEMAIN	4.566443	2.3264034	1.963	0.0500
EDUCAT	–9.209599	3.4699718	–2.654	0.0081
HEALTH	1.501034	1.5857328	0.947	0.3441
INSTALL	–4.105609	0.7568701	–5.424	0.0001
IMAINT	–3.832626	0.7948413	–4.822	0.0001
R&D	–1.171475	1.6416424	–0.709	0.4783
RPM	–0.810453	0.7121832	–1.138	0.2554
SOCIAL	–6.213959	1.1412424	–5.445	0.0001
EARLY	0.138179	1.3377164	0.103	0.9178
EMID	1.301995	1.3792986	0.944	0.3454
LMID	7.079254	1.3181219	5.371	0.0001
LATE	11.859375	1.3247780	8.952	0.0001
RECENT	7.866303	1.3581920	5.792	0.0001
SEALED	–3.152312	0.6335582	–4.976	0.0001
UNRESTRICTED	–4.336270	0.6464736	–6.708	0.0001
DIRECT	–5.305097	0.8343712	–6.358	0.0001

We are not entirely satisfied, however, with the Air Force's duration definition. As shown in the list of dates tracked, the initiative process extends beyond the bid opening date. Hence, this sort of analysis misses potentially important portions of the process. Further, it is unfortunate

Table B.13

Air Force Initiatives, Square Root of Duration Least-Squares Means and Tukey-Kramer Adjusted Standard Errors

Variable Name	Mean	Tukey-Kramer Adjusted Std. Error
ACC	20.5731239	2.4351169
AETC	17.3661864	2.4456253
AFMC	18.7589272	2.4752973
AMC	20.8609306	2.4139133
AFSPC	18.6682651	2.5887542
Other commands	20.2545532	2.4704869
ADP	17.4241723	3.0180810
BASEMAIN	26.2565987	3.1877169
EDUCAT	12.3632058	4.1913878
HEALTH	23.9189464	2.5452212
INSTALL	17.5963802	2.4447421
IMAINT	17.8788214	2.4765513
Other nonmanufacturing	21.7171737	2.4166371
R&D	20.5861338	2.8443713
RPM	20.8856050	2.4580761
SOCIAL	15.5096064	2.5809232
EARLY	14.7960323	2.4785461
EMID	15.9584350	2.4848094
LMID	21.7095742	2.4690349
LATE	26.4745154	2.4804247
RECENT	22.4979422	2.5005592
1994–completion	15.0454871	2.4829301
A-76 cost comparison	21.9948620	2.4242380
Direct conversion	16.8324667	2.4244030

that missing data forced us to restrict our analysis to 927 completed initiatives.

To address these concerns, we defined an alternative measure of duration to be the time between either the announcement or the PWS start date and the award date.[4] We label this the "alternative duration." Even this expanded definition of duration is incomplete, since the in-house MEO or contract starts subsequently. However, missing data plague the last two date fields, even if one appropriately focuses on the MEO when government employees won and the contract start date when the contractor won.

[4]The announcement usually, but not always, comes first.

Table B.14 presents basic statistics using this alternative duration definition.

We repeated the duration analysis above. Our independent variables were the same, except we could also separate negotiated contracts (NEGOT) from contracts for which no type is specified (which became our omitted variable in this category).

Table B.15 presents our alternative duration regression results. Table B.16, meanwhile, presents analysis of covariance-generated means and Tukey-Kramer adjusted standard error estimates for the typical values of some of the dummy variable categories.

Essentially, the results in Tables B.15 and B.16 agree with those in Tables B.12 and B.13. For instance, one sees the same pattern, with completed initiatives apparently becoming more rapid in recent years, while direct conversions are significantly faster to complete than A-76 cost comparisons.

Using either definition of duration, the Air Force's CAMIS data reveal a process that has been lengthy and variable. It would appear the causes of this length and variance include, but go beyond, the A-76 public-private cost comparison process itself. Greater emphasis on direct conversions in lieu of A-76 public-private cost comparisons would speed matters, but only partially. There are systemic delays emanating from how the Air Force develops and writes contracts. Clearly, if one hopes to increase contracting quickly in the Air Force using current mechanisms, that hope seems illusory.

Table B.14

Completed Initiative Alternative Duration Summary

	#	Min	5%	25%	Med	Mean	75%	95%	Max
Alternative Duration (Days)	1,092	76	265	504	697	838	1,042	1,798	3,419

Table B.15

Air Force Initiatives, Alternative Duration Linear Regression

Dependent Variable:	Square Root of Alternative Duration			
R-Squared	0.3545			
Observations	1092			
				F
Analysis of. variance	df	Sum of Squares	Mean Square	21.641
Regression	27	24773.75412	917.54645	
Residual	1064	45112.42713	42.39890	Significance F
Total	1091	69886.18125		0.0001

	Coefficient	Standard Error	t Statistic	P value
Intercept	16.133231	4.94521911	3.262	0.0011
SQRTANMO	–0.012667	0.01058963	–1.196	0.2319
SQRTMILS	–0.105173	0.08064761	–1.304	0.1925
SQRTCIVS	0.360520	0.10414308	3.462	0.0006
MULTI	0.134472	0.86732151	0.155	0.8768
ACC	0.629088	0.81196967	0.775	0.4386
AETC	–2.991529	0.83038223	–3.603	0.0003
AMC	1.611127	0.91152748	1.768	0.0774
AFMC	–1.918640	0.89570911	–2.142	0.0324
AFSPC	–0.289785	1.16704574	–0.248	0.8039
ADP	–3.914261	1.79450095	–2.181	0.0294
BASEMAIN	1.838554	2.01098670	0.914	0.3608
EDUCAT	–5.123912	3.32628250	–1.540	0.1238
HEALTH	–0.935636	1.31468724	–0.712	0.4768
INSTALL	–3.173349	0.68708809	–4.619	0.0001
IMAINT	–1.725907	0.72390676	–2.384	0.0173
R&D	–1.318474	1.38741600	–0.950	0.3422
RPM	–0.424370	0.65376341	–0.649	0.5164
SOCIAL	–8.002000	0.99110557	–8.074	0.0001
EARLY	–0.772764	1.25329203	–0.617	0.5376
EMID	1.661534	1.30113697	1.277	0.2019
LMID	5.389432	1.20996945	4.454	0.0001
LATE	10.752791	1.24679903	8.624	0.0001
RECENT	6.819758	1.29644725	5.260	0.0001
SEALED	10.512779	4.85361716	2.166	0.0305
NEGOTIATE	11.916543	4.84495820	2.460	0.0141
UNRESTRICTED	–3.541130	0.57079022	–6.204	0.0001
DIRECT	–3.661094	0.64241482	–5.699	0.0001

Table B.16

Air Force Initiatives, Square Root of Alternative Duration Least-Squares Means and Tukey-Kramer Adjusted Standard Errors

Variable Name	Mean	Tukey-Kramer Adjusted Std. Error
ACC	22.9623776	1.6994241
AETC	19.3417616	1.7316716
AFMC	20.4146505	1.7723295
AMC	23.9444172	1.7326104
AFSPC	22.0435055	1.9023036
Other commands	22.3332901	1.7640586
ADP	20.2036748	2.3989162
BASEMAIN	25.9564903	2.4664255
EDUCAT	18.9940238	3.6927384
HEALTH	23.1822996	1.8167020
INSTALL	20.9445870	1.7319241
IMAINT	22.3920286	1.7720156
Other nonmanufacturing	24.1179359	1.6943039
R&D	22.7994621	2.1107274
RPM	23.6935664	1.7466659
SOCIAL	16.1159355	1.8724016
EARLY	17.0921112	1.7570450
EMID	19.5264089	1.7653010
LMID	23.2543069	1.7192837
LATE	28.6176665	1.7581237
RECENT	24.6846336	1.7982522
1994–completion	17.8648753	1.8982091
A-76 cost comparison	23.6705475	1.7029867
Direct conversion	20.0094533	1.7005365

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